Florida Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72

December 15, 1999
3F1299-04

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46 (Generic Letter 87-02) - Notification of Commitment Completion and Status for Crystal River Unit 3 (TAC No. M69440)

References:
1. FPC letter 3F1297-24 to NRC, dated December 16, 1997
2. FPC letter 3F0398-16 to NRC, dated March 30, 1998
3. FPC letter 3F1298-01 to NRC, dated December 31, 1998

Dear Sir:

This letter notifies the NRC of completion of the commitments made by Florida Power Corporation (FPC) in referenced letters 1, 2, and 3, regarding Unresolved Safety Issue (USI) A-46 for Crystal River Unit 3 (CR-3) and provides an updated plan for final completion of the outstanding issues.

An executive summary of the status for each USI A-46 topic is provided in Attachment A. The completed actions and the updated plan associated with the resolution of USI A-46 are discussed in Attachment B. As explained in Attachment B, the reviews performed to meet the commitments have identified additional issues that will be addressed by FPC's corrective action program. The actions to address these issues are not considered regulatory commitments. FPC is confident that the information provided is sufficient to consider USI A-46 resolved for CR-3.

If you have any questions regarding this matter please contact Mr. Sid Powell, Manager of Nuclear Licensing, at (352) 563-4883.

Sincerely,

D. L. Roderick
Director, Engineering and Projects

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Attachments:

A. Executive Summary of USI A-46 Resolution
B. Notification of USI A-46 Commitment Completion and Status

cc: Regional Administrator, Region II
Senior Resident Inspector
NRR Project Manager

EXECUTIVE SUMMARY OF USI A-46 RESOLUTION

The following table provides a summary of the Florida Power Corporation (FPC) resolution of the USI A-46 program. The table identifies the topics and their status including how they were resolved. Additional discussion is provided in Attachment B.

Based on the status indicated, FPC concludes that adequate technical basis exists to support the closure of the Unresolved Safety Issue (USI) A-46 for Crystal River Unit 3 (CR-3) by the NRC. Corrective actions remain as open items and are being tracked to completion under the CR-3 Corrective Action Program.

Section Number	Topic	Status
1	Outlier Resolution	All outliers identified in previous correspondence are resolved except for MTSW-3A and -3C. The NRC was notified of MTSW-3A/3C status by an FPC letter dated September 21, 1999.
2	Self Assessment	All self assessments are complete.
3	Equipment Anchorage	The calculations of the anchorage of electrical equipment on the Safe Shutdown Equipment List (SSEL) have been completed. These calculations have demonstrated that the equipment is adequately anchored.
4	GIP Caveats	The applicability of the Generic Implementation Procedure (GIP) caveats at CR-3 have been reviewed. It has been determined that the CR-3 equipment complies with the caveats except in the case of four pumps (SCP-3, GWP-1A and -1B, and CDP-1B.) Resolution of these outliers is being tracked under the CR-3 Corrective Action Program.
5	Emergency Lighting	The seismic adequacy of the emergency lighting and the ability to provide adequate lighting in all required areas were reviewed. The conclusion was that the lighting is adequate based on the availability of hand-held portable flashlights and lanterns.
6	Raceway Supports	FPC will use existing calculations and perform new calculations to document the seismic adequacy of all raceway supports required for safe shutdown of the plant. This action is being tracked under the CR-3 Corrective Action Program.

Section Number	Topic	Status
7	Condensate Storage Tank	The calculation has been completed, verifying that the tank is seismically adequate.
8	Relays	Identification of bad actor relays and guidance for operators to cope with relay chatter during a seismic event are included in Abnormal Procedure (AP)-961, previously submitted to the NRC. Revision of AP-961 to reflect the results of the validation is being tracked under the CR-3 Corrective Action Program.
9	Operability Assessment	The outstanding MTSW-3A and -3C outliers were included in an Operability Concern Resolution which addressed the outliers outstanding at CR-3 startup from the Cycle 11 Design Outage in February 1998. The operability impact of the new outliers identified is addressed in this submittal.
10	EFV-36 Position	The normal position of EFV-36 has been returned to open. The NRC was notified by FPC letter dated November 1, 1999.

NOTIFICATION OF USI A-46 COMMITMENT COMPLETION AND STATUS

A. INTRODUCTION

By letter dated December 31, 1998, Florida Power Corporation (FPC) identified the actions that would be taken to address and resolve the Unresolved Safety Issue (USI) A-46 at Crystal River Unit 3 (CR-3). The commitment stated therein was to complete by December 15, 1999, all of the actions specified in that and in previous FPC letters dated December 16, 1997 and March 30, 1998. This correspondence notifies the NRC of completion of those actions and the results of the additional walkdowns, reviews, and evaluations performed.

The actions taken to complete the commitments, the results, and the conclusions are discussed in Part B of this attachment. The information is presented according to the following section number outline:

1. Outlier Resolution
2. Self Assessments
3. Anchorage Calculations for Electrical Equipment on the Safe Shutdown Equipment List (SSEL)
4. Generic Implementation Procedure (GIP) Caveats
5. Battery Powered Emergency Lighting
6. Raceway Supports
7. Condensate Storage Tank
8. Relays
9. Operability Assessment
10. EFV-36 Position

Also provided in this attachment is a list of abbreviations, in Part C, and a list of references in Part D.

B. DISCUSSION OF COMMITMENT COMPLETION AND RESULTS

Section 1. Outlier Resolution

Commitment:
FPC has improved upon the schedule and will be completing resolution of all outliers prior to startup from Refueling Outage 11. FPC will provide confirmation of completion of resolution of all outliers.

Resolution:
The specific USI A-46 outliers at CR-3 identified in Enclosures 3 and 4 of FPC letter to the NRC dated December 16, 1997 (Reference 3), have been resolved. Outlier resolution efforts are documented on the Screening Evaluation Worksheet (SEWS) for each component. The SEWS associated with the USI A-46 project are contained in FPC Calculation S99-0093 (Reference 14).

Two exceptions are MTSW-3A, 480V Turbine Auxiliary Bus A, and MTSW-3C, 480V Reactor Auxiliary Bus A. Resolution of these two outliers has been deferred to the Cycle 12 Refueling Outage (12R), scheduled for fall 2001. The NRC was informed of this deferral by letter dated September 21, 1999 (Reference 8). Resolution of these outliers is included in the CR-3 Corrective Action Program (Reference 20).

Commitment:
At the conclusion of the outlier resolution effort, there will be no unanchored SSEL equipment.

Resolution:
All equipment on the CR-3 Safe Shutdown Equipment List (SSEL) is now properly anchored in accordance with the GIP, except for MTSW-3A and 3C discussed above.

Commitment:
FPC will have completed the resolution of all restart outliers prior to restart from the current outage [The "current outage" is referring to the Cycle 11 Design Outage (11D)].

Resolution:
All outliers required for restart from the 11D outage were resolved prior to restart from that outage. CR-3 resumed power operation from the 11D outage in February 1998.

Commitment:
At the completion of outlier resolution, there will be no SSEL related adjacent cabinets that are not bolted or otherwise attached together.

Resolution:
All identified electrical cabinets that are adjacent to cabinets with the potential for seismic interactions are now attached together.

Section 1 Conclusion:

All USI A-46 outliers previously identified are resolved except for MTSW-3A and MTSW-3C. Resolution of these outliers is included in the CR-3 Corrective Action Program (Reference 20).

Section 2. Self Assessments

Commitments:

- *As part of closure of our program, a confirmatory self-assessment will be conducted. FPC will inform the NRC about the results of the audit concerning all open issues regarding USI A-46 for CR-3. Review to include: audit of SSEL, resolution of all outliers, and review of anchorage calculation.*

- *FPC committed to perform a confirmatory self-assessment of USI A-46 activities for Crystal River Unit 3 (CR-3). The effort will assess the completeness of the resolution of USI A-46 issues. As committed previously, FPC will forward the results of the audit to the NRC. Also as part of that self-assessment, FPC will consider the need for a more detailed emergency lighting analysis along with a detailed review of local operator actions to identify those that may be affected by potentially adverse environmental conditions resulting from the seismic event. In addition, the assessment will include a validation of a previous review of the "bad actor" relay list.*

- *FPC will reexamine the completeness of the SSEL by involving engineers with backgrounds in all aspects of safe shutdown path identification and equipment functionality to confirm that no equipment items need to be added to the current SSEL. FPC will verify whether all equipment items on the SSEL are appropriately classified. Re-evaluation will be necessary for inappropriately classified equipment.*

Resolution:

The above three commitments contain overlapping subject areas. For that reason, the discussion of their resolution is presented by the subject areas rather than addressing each commitment individually.

A. Independent Assessment of Anchorage Calculations

This action is related to the commitments made to address the anchorage of electrical equipment. Calculations were performed to ensure that all SSEL electrical equipment is anchored in accordance with the requirements of the GIP. These calculations and the results are summarized in Section 3. These calculations were accomplished by means of either a unique calculation applicable to the configuration of specific components, a calculation that enveloped similar components, or by referencing existing design documentation.

The anchorage calculation (Reference 15) is a compilation of the bounding qualification analyses that demonstrate seismic qualification of all the electrical components on the current SSEL. The enveloping calculations evaluated either a component with a less substantial anchor configuration or a component with a higher seismic demand than the other components in the enveloped grouping. This ensured the results of the calculations were bounding and that the applicable group of components was qualified.

Some calculations that were used to verify the acceptability of the components were existing FPC calculations that had been developed in support of recent plant modifications. The referenced calculations were prepared separate from the effort specifically designed to address the USI A-46 concerns and did not necessarily apply the GIP methods. They were, however, performed to the current standards and methods for evaluating seismic loading. The calculations determined that these existing anchorages met or exceeded the requirements of the GIP.

B. Assess the Adequacy of Emergency Lighting

FPC has completed an assessment of emergency lighting as discussed in Section 5.

C. Assess the Effects of Adverse Environmental Conditions Resulting From A Seismic Event

An assessment of the environmental conditions that are expected to exist after a seismic event has been completed. A walkdown performed by a Seismic Review Team (SRT) concluded that the environmental conditions resulting from the Safe Shutdown Earthquake (SSE) will not impact the ability of personnel to perform the actions required to respond to the event. This was addressed in a walkdown performed by Duke Engineering & Services (DE&S) Seismic Capable Engineers (SCE) during their review of the SSEL (discussed in Item F below) [Reference 19]. This walkdown included a broad review of overhead structures, distribution systems [raceways, piping, and heating, ventilation, and air conditioning (HVAC)], and other components in the CR-3 Control, Turbine, Intermediate, and Auxiliary Buildings.

D. Validate the "Bad Actor Relay" List

FPC had previously notified the NRC, by letter dated March 30, 1998 (Reference 5), that there were 74 "bad actor relays" at CR-3. Abnormal Procedure (AP)-961, "Earthquake", was revised by adding a list of the alarms associated with the relays. The revised AP-961 was submitted to the NRC by letter dated January 30, 1999 (Reference 4.) FPC completed a validation of the list by reviewing electrical drawings, performing walkdowns, and researching CR-3 modifications. This validation identified additions and deletions from the list previously prepared. Based on the validation results, FPC has concluded that there are no "bad actor relays" which would have an adverse impact on the ability of CR-3 to shut down after an SSE. AP-961 will be revised to reflect the results of the validation. This action will be tracked under the CR-3 Corrective Action Program.

E. Review Completion of All Outliers

FPC has completed a review of all outliers. Further information regarding open items associated with outliers is presented in Section 4.

F. Perform an Audit, or Assessment, of the CR-3 Safe Shutdown Equipment List

The assessment has been completed and concluded that the SSEL contains the components required to accomplish the functions necessary for CR-3 to achieve and maintain a safe shutdown condition following the SSE.

To accomplish this task, FPC contracted DE&S to perform an assessment of the SSEL based on the Seismic Qualification Utility Group (SQUG) GIP [Reference 9]. DE&S verified that the FPC equipment selection process was consistent with the requirements of Section 3 of the GIP. The classification of components on the SSEL was verified to be consistent with the equipment classifications identified in Table 3-1 of the GIP. The DE&S report concluded that the original SSEL as submitted to the NRC (Reference 1) is complete in representing the required safe shutdown equipment and that the equipment on the SSEL is properly classified.

The SSEL assessment consisted of reviewing the highlighted flow diagrams and one-line diagrams originally developed by FPC with the Composite SSEL. The review of the SSEL focused on the equipment selection process, component classification, primary and alternate path designation, and seismic evaluation requirements. The DE&S engineers that performed this review have broad industry experience in the development and review of safe shutdown paths for SQUG. A multi-discipline review of the SSEL was accomplished by having an experienced Electrical/Systems Engineer prepare the initial list, and having an experienced Mechanical/Systems engineer (DE&S) review it. The DE&S engineers had successfully completed the SQUG Equipment Selection and Relay Evaluation Training Course. The original SSEL was reviewed by the CR-3 Operations Department.

The report recommended enhancements to the SSEL such as adding equipment needed for completeness but for which a seismic review is not required, adding train designators, and making editorial revisions such as adding drawing numbers and clarifying notes, and correcting minor errors. FPC has revised the SSEL to address these enhancements, as appropriate. No new outliers resulted from this effort. The complete documentation of the SSEL assessment is included in CR-3's Engineering Evaluation (EE) EES-99-014, (Reference 19).

Section 2 Conclusion:

All FPC assessments of the USI A-46 program are complete.

Section 3. Anchorage Calculations for Electrical Equipment on the Safe Shutdown Equipment List (SSEL)

Commitments:

- *FPC will perform GIP anchorage calculations for approximately 50% (100) of electrical components currently identified on the SSEL. FPC may expand the scope of the calculations utilizing statistical methods.*

- *Perform anchorage calculations using GIP-2 methodology, for approximately 50 percent of the electrical equipment on the Safe Shutdown Equipment List (SSEL). FPC estimates that approximately 100 component anchorage calculations will be required to satisfy this commitment. (The approximately 100 pieces of equipment will be selected to represent or bound all of the electrical equipment on the SSEL.) The calculations will include review of the Screening Evaluation Work Sheets (SEWS) for all of the electrical equipment on the SSEL to identify the limiting cases of anchorage type, bolt pattern, and uniqueness. Equipment will be selected that bounds similar equipment of a lesser seismic demand. Walkdowns and inspections will be performed as required to complete and verify these calculations.*

Resolution:

The objective of the calculation effort was to demonstrate that the electrical equipment on the SSEL was adequately anchored. To address these commitments, Programmatic Solutions, Inc. (PSI) and Stevenson & Associates (S&A) performed GIP-style calculations for selected electrical equipment (Reference 15) under contract to FPC. The work performed to meet this objective consisted of the following separate tasks:

1. Review the SSEL to identify candidate items of equipment.
2. Review the SEWS for these items to identify available drawings, anchorage details/sketches.
3. Perform walkdowns of the SSEL electrical equipment. A Seismic Review Team (SRT) consisting of two trained and SQUG-certified SCEs performed these walkdowns. FPC personnel (electrical, systems, operations, craft, etc.) were consulted and provided assistance to the walkdown team, on an as-needed basis, to obtain access to all items of SSEL electrical equipment.
4. Perform an assessment of the bolt tightness (torque testing) and random embedment checks (for shell-type anchors) previously performed to confirm compliance with the requirements of the GIP.
5. Review the data collected in the above steps in order to select the calculations required to bound all SSEL electrical equipment anchorages. This included a review of several existing anchorage calculations performed subsequent to completion of the original USI A-46 Program walkdowns.

6. Perform 84 additional anchorage calculations to assure that a bounding calculation exists for every item of electrical equipment on the SSEL.
7. Gather all the above information into a single calculation format.

Section 3 Conclusion:

Evaluations have been performed to ensure that a bounding or actual anchorage analysis exists that demonstrates acceptable anchorage for every piece of SSEL electrical equipment. These new anchorage calculations are documented as a single FPC calculation (Reference 15).

Section 4. Generic Implementation Procedure (GIP) Caveats

Commitment:
For the following GIP-2 caveats:

- *Doors/Buckets Secured*
- *Evaluate Computers and Programmable Controllers Separately*
- *Evaluate Strip Chart Recorders Separately*
- *Contains only Circuit Breakers and Switches*

FPC will obtain a signed letter from each Seismic Capable Engineer (SCE) external to FPC documenting that these caveats were considered as part of the walkdowns. These letters will be placed in the SEWS files. FPC will perform a walkdown of a sample of these caveats to ensure there are no concerns. The sample will consist of at least ten percent of the associated population. If any outliers are identified in the population that should have been identified during the original walkdowns then the entire population will be re-evaluated

Resolution:
The above caveats are adequately addressed for the CR-3 SSEL equipment. This is based on the supporting justification and validation provided by the SCEs and the sample walkdowns of the SSEL equipment that were performed.

Programmatic Solutions, Inc. (PSI) developed a report (Attachment "A" of Reference 18) certifying that the four prescreened caveats discussed above were adequately considered in the initial walkdowns. This report is signed by the three SCEs involved in the seismic walkdowns and completion of the SEWS.

FPC evaluated the results of numerous walkdowns previously performed at CR-3 (Reference 18) and verified that they provided the desired assurances that no additional outliers based on the above caveats would be identified. These previous walkdowns were performed to the full GIP requirements. Based on this, FPC concluded that the additional walkdown of a ten percent sample was not necessary.

Commitment:
For the following GIP-2 caveats:

- *Attached Weight of 100 Pounds or Less*
- *Cutouts Not Large*
- *No Possibility of Excessive Duct Distortion*
- *Check of Long Unsupported Piping*

FPC will perform an additional walkdown to determine whether the current configuration satisfies these caveats. This walkdown will address the specific caveats for the affected equipment classes that were previously excluded from consideration. Appropriate notes, observations, and assessments will be made to document the results of these walkdowns, i.e. whether the caveats are satisfied and actions to be taken if they are not satisfied.

And

Commitment:
For the following GIP-2 caveats:

- *Valve Body Not of Cast Iron*
- *Valve Yoke Not of Cast Iron*
- *Valve Operator Cantilever Length*
- *Mounted on One-Inch Diameter Pipe or Greater*
- *Actuator and Yoke Not Independently Braced*

FPC will perform a search of the CR-3 Configuration Management Information System, review drawings and photographs, and perform additional walkdowns as necessary to determine whether the current configuration satisfies these caveats. The results of these walkdowns will be documented.

Resolution:
The above caveats are adequately addressed for the CR-3 SSEL equipment. This is based on the walkdowns performed and the plan for resolution of the new outliers as discussed below.

To address both commitments, Duke Engineering and Services (DE&S) performed plant walkdowns and evaluations, and reviewed existing drawings and photographs where equipment was inaccessible. The findings were documented on GIP SEWS sheets. The DE&S report (Attachment "B" of Reference 18) included GIP SEWS for all SSEL equipment with the above caveats. In all cases, sufficient information was available for the two DE&S SCEs to agree on the assessment. The DE&S report and associated GIP SEWS confirm the above GIP caveats have been satisfied.

The DE&S walkdowns identified five new outliers associated with differences between the caveats of the GIP and those of the Plant Specific Procedure (PSP) (Reference 10). These are the only new outliers identified through the additional efforts discussed in this submittal.

The five components identified as new outliers are listed below. The valve was declared an outlier due to the caveat, *Valve Operator Cantilever Length.* The four pumps were declared outliers due to the caveat, *Check of Long Unsupported Piping.* Specifically, the outlier for these pumps is the long unsupported piping on the discharge side of the pumps. These four non-safety related pumps are located in the basement of the Turbine Building. The piping runs are supported by rod hangers, which is the typical design for piping in the Turbine Building. The SSEL basis (Attachment "F" of Reference 19) reflects that these four pumps are included on the SSEL only because they are part of the pressure boundary.

MUV-31, Discharge Line Flow Control for MUP-1A/1B/1C to RCP-1A

MUV-31 was identified as an outlier because the valve operator length exceeded the recommendations of the GIP. This valve is included in a piping analysis that evaluated the valve accelerations versus allowable acceleration levels. The valve was determined to be acceptable as is (Reference 18).

SCP-3, Secondary Service Water Booster Pump

SCP-3 is included on the SSEL to provide cooling water to the Instrument Air System. Failure of SCP-3 could lead to a loss of secondary cooling water used to service the Instrument Air System. Operability Concerns Report (OCR) 98-001 (Reference 23) was prepared to address startup from the 11D outage with open USI A-46 outliers. OCR 98-001 addresses loss of Instrument Air. No further justification is required for failure of SCP-3.

GWP-1A and GWP-1B, Condensate Injection Pumps

Pumps GWP-1A and GWP-1B are included on the SSEL only as identified pressure boundary components off the Condensate Storage Tank (CDT-1). There are suction line isolation valves for both pumps. These isolation valves are manually operated valves and can be used to isolate the pumps from CDT-1, if required. The pump is not required to function and the discharge piping can be isolated. Therefore, operability of CDT-1 is ensured.

CDP-1B, Condensate Pump

CDP-1B is included on the SSEL only as part of the pressure boundary off the condenser hotwell. There is a suction line isolation valve for this pump. This isolation valve is a manually operated valve and can be used to isolate the pump. The pump is not required to function and the discharge piping can be isolated. Therefore, operability of the hotwell is ensured.

Resolution of these outliers is included in the CR-3 Corrective Action Program (Reference 20).

Commitment:
For the following GIP-2 caveat:
- *No reliance on Weak-Way Bending of Steel Plate or Structural Steel Shapes*

FPC will examine photographs and perform a bounding calculation to address this GIP-2 caveat.

Resolution:
Weak-way bending was addressed by EES-99-012 (Reference 17). This evaluation documents that this caveat, as it applies to transformers, battery chargers, chillers, and inverters, is acceptable. This evaluation included a discussion on each component in these equipment classes. The evaluation showed that the caveat was met by either bounding calculations, further walkdown, or engineering judgment of the SCEs.

Section 4 Conclusion:

FPC has adequately addressed all GIP caveats for CR-3 SSEL equipment. Resolution of the outliers discussed above and in Section 1 is included in the CR-3 Corrective Action Program (Reference 20).

Section 5 Battery Powered Emergency Lighting

Commitment:
FPC will evaluate all of the plant emergency battery-powered lighting to verify it is seismically rugged. Any deficiencies will be evaluated and resolved to ensure operator actions in Abnormal Procedures (APs) or Emergency Operating Procedures (EOPs) are not impacted. The impact review will be conducted in accordance with the AP/EOP verification and validation process. One of the requirements of this verification and validation process is to ensure that adequate lighting is available for performance of required operator actions. This lighting evaluation considers both normal and loss-of-offsite power (LOOP) conditions, including possible reliance on emergency battery-powered lighting, or the use of hand-held lighting.

Resolution:
Confirming the seismic adequacy of the emergency lighting consists of three areas: (1) the seismic adequacy of the light units themselves; (2) the seismic adequacy of the mounting of the light unit to the building structure; and (3) the required compensatory or independent (hand-held) lighting if the battery-powered lighting is unavailable. All three areas are necessary to confirm adequate lighting exists to allow operators to manipulate equipment, as required, by an AP or EOP in the event there is a loss of regular lighting.

These three issues are discussed in EES-99-010 (Reference 16). The evaluation includes a review of the plant emergency battery powered lighting currently identified in FPC's Configuration Management Information System (CMIS) and Surveillance Procedure (SP)-807, "Mounted Emergency Battery-Powered Light Units" (Reference 28). This evaluation concludes the lighting units are all adequately mounted to building structures.

Purchase of the emergency light units as seismically qualified is not required. The light units were inspected for seismic vulnerabilities. The control boards mounted inside the light units are considered the seismic weak link. Seismic motion may cause the reed switches to chatter. However, the seismic motion lasts only a few seconds and if chatter were to occur, the lights would simply cycle on and off for a short period of time. Because no definitive information could be found on the seismic adequacy of the control devices, the lights are assumed to fail. In this extreme case, the compensatory actions described below will provide adequate lighting to assist the operators.

FPC procedure Administrative Instruction (AI)-402C, "AP and EOP Verification and Validation Plan" (Reference 27) requires that AP and EOP steps be validated. This validation process requires that sufficient lighting exist to perform the AP/EOP procedure step. This applies to all operating conditions. If hand-held lighting has been determined to be required, then it must be provided nearby. Flashlights and portable lanterns are available in storage boxes located throughout the plant.

Section 5 Conclusion:

Adequate emergency lighting exists at CR-3 through the use of portable hand-held flashlights and lanterns as compensatory actions. Credit is taken for existing AP/EOP validation procedures.

Section 6. Raceway Supports

Commitment:
FPC will verify that bounding documentation is available to show that all raceways required for safe shutdown of the plant are seismically adequate. Specifically, existing design basis calculations and walkdown information will be reviewed to ensure that it provides assurance equivalent to that provided by GIP-2 methodology. In cases where the existing documentation does not provide this level of assurance, additional walkdowns and/or calculations will be performed.

Resolution:
This commitment was that FPC would demonstrate that all raceways required for safe shutdown equipment are seismically adequate. This commitment provides the option of demonstrating raceway support adequacy by either design basis calculations or GIP methodology calculations. The existing design basis calculations demonstrate seismic qualification of non-typical, safety related, cable tray supports. Cable tray support designs in the Turbine Building are non-safety related. A previously submitted Limited Analytical Review (Reference 12) was intended to bound the non-safety, rod-hung, cable tray supports. Non-typical raceway supports have been reviewed as part of the 10 CFR Part 50 Appendix R program, Mecatiss (cable fire retardant) installation, maintenance rule base line walkdowns, and modifications made during 11R. These reviews provide assurance that non-typical cable tray supports are seismically qualified.

The remaining supports are the typical cable tray supports shown on Reference 26. Due to shortcomings in the existing calculation, FPC made the commitment below to ensure adequate documentation would exist for the typical cable tray supports.

Commitment:
FPC will prepare a new calculation package, in accordance with current design and licensing basis requirements, to demonstrate the adequacy of the typical supports for cable trays. This effort will be completed by December 15, 1999, with other USI A-46 actions.

Resolution:
Stevenson & Associates (S&A) performed a calculation using current criteria, methods, and standards. S&A began preparation of this calculation using the worst case typical design configuration coupled with using the peak responses of the current floor response spectra and other conservatisms used in the current criteria (which is conservative in relationship to the GIP methodology). The typical supports contain too many variables to perform these calculations without performing additional walkdowns to gather supporting information. Shortly before the start of the CR-3 11R refueling outage, FPC concluded that this calculation approach was not viable for qualifying the typical supports.

FPC has reconsidered this commitment and has concluded that there is no safety or cost benefit to performing a new calculation on the typical supports using current design codes and standards. FPC has concluded that a calculation based on the GIP methodology would provide

adequate documentation of the typical cable tray supports. FPC has performed preliminary calculations with positive results and is confident that this methodology will demonstrate that the typical cable supports are seismically qualified. Manpower requirements needed to support the 11R outage, conducted during October and November 1999, have prevented the completion of this effort as originally committed by December 15, 1999.

FPC will prepare an evaluation that will verify that bounding documentation is available to show that all raceways required for safe shutdown of the plant are seismically adequate. Specifically, existing design basis calculations and walkdown information will be reviewed to ensure that it provides assurance equivalent to that provided by GIP-2 methodology. In cases where the existing documentation does not provide this level of assurance, additional walkdowns and/or calculations will be performed based on the GIP. This evaluation also will address comments in the NRC's Safety Evaluation Report to further justify that safe shutdown raceway supports are adequate. This action is included in the CR-3 Corrective Action Program (Reference 20.)

The cable tray supports have been extensively reviewed and examined by previous walkdowns. On this basis, FPC maintains there is no safety significance in this change in commitment from that made in Reference 7.

NRC Request for Additional Information: "Cable Tray Support Calculation"

During an NRC audit of the CR-3 USI A-46 program conducted in November 1997, the NRC requested copies of cable tray calculations. In response, FPC informally provided to the NRC a cable tray calculation entitled "FPC Crystal River Cable Tray Seismic Supports" (Reference 25). This calculation demonstrated that the cable tray supports at CR-3 have been analyzed for seismic loading and reflected the original efforts taken at CR-3 to seismically qualify cable tray supports.

In Enclosure 2 of the NRC letter dated April 10, 1998 (Reference 6), the NRC requested additional information based on their review of that cable tray calculation. FPC's response to the request (Attachment "D" of Reference 7) contained the second commitment identified above which was to prepare a new calculation package in accordance with current design and licensing basis requirements to demonstrate the adequacy of the typical supports for cable trays. With the redirection of efforts to utilize the GIP methodology as described above, FPC provides the following as the response to the NRC concerns.

<u>NRC Concern</u>
"The calculations do not contain a comprehensive discussion of the allowable stresses used, including the basis for their use and reference to the industry code criteria. We requested this information during our audit. Additionally, it appears that the calculations have not been independently reviewed and verified."

FPC Response
The calculation provided to the NRC did not have a cover page as is standard for calculations prepared by Gilbert/Commonwealth, Inc (G/CI). The typical G/CI calculation cover page includes the preparer, verifier, and approver signatures. This page also typically includes a summary of the design codes and standards. The cover page for this particular calculation could not be located. As a result, FPC cannot state conclusively that this calculation has been independently reviewed and verified.

The body of the calculation does not contain a summary of the industry code criteria. The industry code in effect at the time of this calculation is not noted in the calculation. However, the code typically used was the American Institute of Steel Construction (AISC). The AISC provides allowable stress requirements for structural elements.

The actions to be taken to address the above second commitment discussed in the Resolution will result in documentation that provides assurance that the typical cable tray supports are seismically adequate.

NRC Concern [This concern is based on Page 8:01.11 of the calculation]
"Assumptions used for obtaining the moment at the ceiling attachment point do not appear to be valid. It appears that the load from the cables, which in certain cases are as much as 22 feet from the support, were transferred to 5 feet assuming rigid body load transfer and guided cantilever deformation for the vertical member. Based on our conservative calculations, we estimate that the stresses at the vertical member would be significantly higher."

FPC Response
A more conservative analysis using the 22 feet, as discussed by the NRC, would lead to more conservative stresses. The calculation sent to the Staff was prepared in the early 1970 timeframe and is typical for that time period. The qualification method used in the calculation is an approximation method called the "portal method" and is referenced in textbooks (Reference 24) as being an acceptable design approximation method. The method leads to approximate results that may or may not be conservative. A review of the calculation shows a large difference (or margin) between the calculated values and allowable values. This ensures the "approximate" results do not approach code limits.

Section 6 Conclusion:

The additional reviews and calculations to be done on the raceway supports will demonstrate that the raceway supports required for safe shutdown of CR-3 are seismically adequate. The responses to the above NRC requests for additional information provide adequate information to address those requests.

Section 7. Condensate Storage Tank

Commitment:
FPC to complete a calculation for CDT-1 that will demonstrate that the tank is seismically qualified. This calculation will be submitted to the NRC for review.

[As discussed with the NRC Project Manager, a summary of the calculation is being submitted in lieu of the complete calculation.]

Resolution:
FPC's calculation demonstrates that the seismic demand placed on the Condensate Storage Tank (CDT-1) due to a Safe Shutdown Earthquake (SSE) does not exceed the seismic capacity of the tank.

CDT-1 is a component on the USI A-46 SSEL. This tank provides a backup source of water for the Emergency Feedwater Pumps. The original verification that CDT-1 was qualified to the requirements of the USI A-46 program was contained in FPC Analysis Calculation S94-0011 (Reference 11). However, while performing an in-house review of this calculation, FPC discovered an error in applying the methodology of the GIP. This error involved calculations for determining the seismic demand. This finding was documented in the CR-3 Corrective Action Program (Reference 21). This error caused the tank to become an outlier. During an NRC audit in November 1997, FPC informed the NRC of this new outlier and agreed to resolve the issue.

FPC utilized Sargent & Lundy (S&L) to perform a new calculation of the seismic demand. Their calculation has been incorporated into FPC's Document Control System as Calculation S98-0412, Revision 0, "Seismic Qualification of Condensate Storage Tank to USI A-46 Requirements" (Reference 13). The capacity of the tank was calculated using the formula and tables from the GIP. This calculation assumed a brittle failure of the bolts.

Seismic Capacity:	Shear Force	= 870 kips
	Moment	= 35200 kip-inch

To determine the seismic demand on the tank, S&L performed various computer analyses to develop a Soil Structure Interaction (SSI) model of the tank. Several steps are involved in this process.

1. Calculate a free field horizontal input seismic motion to be consistent with the CR-3 site-specific response spectrum with 4% damping. This step used an in-house S&L computer program.
2. Construct a fixed-base model of the tank using appropriate amounts of water impulsive and convective masses. The impulsive mass is treated as a distributed mass over the tank height. The convective mass is considered a lumped mass.

3. Construct a coupled tank-foundation model using an S&L computer program to perform the SSI analysis. In the SSI analysis, 4% damping is used for elements that represent the tank wall and 0.5% damping is used for the element that connects the convective mass to the base of the tank.
4. Three sets of foundation properties are calculated and are used in three separate SSI analyses. These material properties correspond to upper bound, average, and lower bound material properties.

Using the above steps, an accurate calculation of seismic demand for base moment and shear has been made utilizing a coupled model of tank, soil, and rock to directly consider the SSI effects. This further uses three sets of foundation material properties to consider lower bound, average, and upper bound sets of parameters.

The total shear force and the total moment at the base of the tank is calculated by applying the square root of the sum of the squares (SRSS) method for combining the absolute forces and moments from the appropriate computer data points. The following is a summary of the analysis results.

Seismic Demand:	Shear Force	= 164 kips
	Moment	= 32268 kip-inch

The factor-of-safety is calculated using the seismic capacity and the seismic demand above.

Shear force:	Capacity / Demand	= 870/164
		= 5.3 <u>OK</u>
Moment:	Capacity / Demand	= 35200 / 32268
		= 1.09 <u>OK</u>

Based on the factors-of-safety above being greater then 1.0, the SQUG outlier issue of CDT-1 is resolved.

Dr. Robert P. Kennedy of Structural Mechanics Consulting, Inc., performed an independent assessment on the new calculation in response to FPC's request. This included a review of the seismic capacity calculation included in the earlier calculation. One of Dr. Kennedy's significant comments concerned the conservatism in the seismic capacity calculations. His assessment concluded the seismic capacity of the tank could assume a ductile failure of the bolts that would lead to even higher capacity and thus increase the factor of safety discussed above. Dr. Kennedy also has reviewed the methodology and demand calculation results of this calculation. With Dr. Kennedy's assessment that the capacity can be increased, he considered the tank safe for a 4% damped 0.1g site-specific response spectrum.

Section 7 Conclusion:

The calculation for CDT-1 is complete. The tank is seismically qualified to the requirements of the GIP.

Section 8. Relays

Commitment:
FPC will revise the PSP to incorporate comments on relay review

Resolution:
The CR-3 Plant Specific Procedure (PSP) [Reference 18] was revised by addition of the following text to Section 6, "Relay Functionality Review".

> *Relays on an individual basis are excluded from the scope due to the low number of actuations anticipated at a low seismic site such as CR-3, and the ability of the operators to quickly diagnose and react to any relay actuations that may occur. Relays, in general, will be evaluated by having the Seismic Capability Engineers verify that existing relays are installed properly and are properly supported. Cabinets, panels, transformers, and other components that may contain relays will be examined to verify relay installation. Other than identifying the "Bad-Actor" relays, FPC will not identify individual essential relays.*
>
> *6.1 FPC COMMITMENTS:*
> *FPC will commit to the following in regard to reviewing relays and relay functionality.*
>
> *6.1.1 Identification of Relays To Be Evaluated*
> *Cabinets, panels, transformers, and other components that may contain essential relays will be added to the SSEL. Therefore, a subset of plant equipment will be added to the SSEL that is not specifically required for Safe Shutdown. However, this equipment may contain essential relays that require a functionality review. This will envelope all essential relays in the safe shutdown path.*
>
> *6.1.2 Evaluation of Consequences of Relay Malfunction*
> *To enhance relay performance during and following an earthquake, FPC will take the following measures for any cabinets or equipment containing relays (Note: no effort is being made to identify essential relays).*
>
> - *Seismic interaction, including mild bumping, is not allowed on these cabinets.*
> - *Anchorage of these cabinets will be reviewed to assure that local uplift and impact of cabinet base does not occur.*
> - *Observable relays will be examined by the Seismic Capability Engineers to verify proper installation (as intended by the manufacturer). The engineers shall also note any unusual relay orientation and support arrangement for further evaluation.*
> - *Procedure AP-961, "Earthquake," provides operator instructions in the event of an earthquake. This procedure has been revised to list annunciators that may be affected by "Bad Actor" relays. Appropriate operator actions can then be taken. No identified "Bad Actor" relays provide an essential function. If the "Bad*

Actor" relay is only to provide alarm, or indication functions, and this function has adequate compensatory measures, then replacement is not required.

This is Revision 2 to the PSP. FPC has no plans to further revise the PSP.

Commitment:
Revise Abnormal Procedure AP-961, Earthquake, to include identification of the bad actor relays and guidance for operators to cope with relay chatter subsequent to a seismic event. Submit revised AP-961 to NRC for information.

Resolution:
AP-961 has been revised to address this commitment. Revision 8 of AP-961 was submitted to the NRC by letter dated January 30, 1998 (Reference 4). AP-961 will be revised to reflect the results of the validation discussed in Section 2, "Self Assessments." This action is being tracked under the CR-3 Corrective Action Program.

Section 8 Conclusion:

The issue of relays for CR-3 is addressed by identifying the bad actor relays at CR-3 and incorporating into AP-961 the associated alarm points and guidance for operators to cope with relay chatter subsequent to a seismic event.

Section 9 Operability Assessment

Commitment:
The remaining twenty-six (26) post-restart outliers will receive an operability assessment prior to restart from the current outage to confirm that the failure of any of the outstanding non-safety related outliers will not affect the ability to achieve safe shutdown of the plant. The assessment will also include a review of any seismic interaction concerns.

Resolution:
In response to an NRC request, FPC developed Operability Concerns Resolution (OCR) 98-0001 (Reference 23) prior to restart from the 11D outage. That OCR documented why it was acceptable to restart from 11D with the USI A-46 outliers that were outstanding at that time.

The outliers that remain to be resolved are non-safety related. MTSW-3A and MTSW-3C are addressed in OCR 98-0001. The impact on CR-3 operability of failure of the recently identified outliers (SCP-3, GWP-1A and 1B, and CDP-1B) is addressed in Section 4.

Section 9 Conclusion:

Operation of CR-3 during Operating Cycle 12 with the remaining outliers is safe.

Section 10. EFV-36 Position

Commitment:
FPC will evaluate the advantages of returning EFV-36 to a normally open status to eliminate this potential single failure. The results of the evaluation will be submitted to the NRC.

Resolution:
EFV-36 has been returned to a normally open status. FPC notified the NRC of this change by letter dated November 1, 1999.

Section 10 Conclusion:

Returning EFV-36 to a normally open position ensures an adequate source of feedwater is available for CR-3 to achieve and maintain hot standby conditions after an SSE.

C. LIST OF ABBREVIATIONS

11D	Cycle 11 Design Outage
11R	Cycle 11 Refueling Outage
AP	Abnormal Procedure
CMIS	Configuration Management Information System
CR-3	Crystal River Unit 3
DE&S	Duke Engineering and Services, Boston, Massachusetts
EE	Engineering Evaluation
EOP	Emergency Operating Procedure
FPC	Florida Power Corporation
G/CI	Gilbert/Commonwealth, Inc
GIP	Generic Implementation Procedure
HVAC	Heating, Ventilation, and Air Conditioning
LOOP	Loss Of Offsite Power
NRC	Nuclear Regulatory Commission
OCR	Operability Concerns Resolution
PSI	Programmatic Solutions, Inc., Northport, New York
PSP	Plant Specific Procedure
S&A	Stevenson and Associates, Boston, Massachusetts
SCE	Seismic Capable Engineer (experienced and trained Civil/Structural Engineer as defined by the GIP)
SEWS	Screening Evaluation Worksheets
SQUG	Seismic Qualification Utility Group
SRT	Seismic Review Team (consists of at least two SCEs)
SSE	Safe Shutdown Earthquake
SSEL	Safe Shutdown Equipment List
USI	Unresolved Safety Issue

D. LIST OF REFERENCES

Correspondence:

1. FPC letter to NRC dated December 31, 1995, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue A-46" [3F1295-18].
2. NRC letter to FPC dated May 2, 1996, "Evaluation of Florida Power Corporation's Plant-Specific Criteria and Procedures for Implementing the Resolution of USI A-46 at Crystal River Unit 3" [3N0596-04].
3. FPC letter to NRC dated December 16, 1997, "Crystal River 3 – Supplemental Response for Resolution of Unresolved Safety Issue A-46, (TAC No. M69440)" [3F1297-24].
4. FPC letter to NRC dated January 30, 1998, "Supplemental Response for the Resolution of Unresolved Safety Issue (USI) A-46)" [3F0198-42].
5. FPC letter to NRC dated March 30, 1998, "Request for Additional Information Regarding Summary Report on the Verification of Seismic Adequacy of Mechanical and Electrical Equipment dated December 31, 1995 " [3F0398-16].
6. NRC letter to FPC dated April 10, 1998, "Audit Report of Unresolved Safety Issue A-46, Seismic Implementation and Subsequent Evaluations of Related Issues at Crystal River Unit 3, (TAC No. M69440)" [3N0498-07].
7. FPC letter to NRC dated December 31, 1998, "Response to NRC Request for Additional Information Regarding Unresolved Safety Issue (USI) A-46, (TAC No. M69440)" [3F1298-01].
8. FPC letter to NRC dated September 21, 1999, "Crystal River Unit 3 - Change of Commitment for Unresolved Safety Issue (USI) A-46, (TAC No. M69440)" [3F0999-20].

Procedures:

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

FPC Analysis/Calculations:

11. S94-0011, Revision 1, "Seismic Verification of Tanks – SQUG Methodology."
12. S97-0542, Revision 0, "CR-3 Structural Seismic Margin Evaluation (Study)."
13. S98-0412, Revision 0, "Seismic Qualification of Condensate Storage Tank to USI A-46 Requirements."
14. S99-0093, Revision 0, "Summary of USI A-46 Seismic Evaluations." Calculation contains the Screening Evaluation Worksheets (SEWS) for the CR-3 USI A-46 program.
15. S99-0340, Revision 0, "Anchorage Calculation for USI A-46 Safe Shutdown Electrical Equipment."

FPC Engineering Evaluations (EE):

16. EES-99-010, Revision 0, "Seismic Assessment of Battery-Powered Emergency Lighting."
17. EES-99-012, Revision 0, "Weak-Way Bending Analysis to Address GIP Caveats."
18. EES-99-013, Revision 0, "Assessment of Generic Implementation Procedure (GIP) Caveats for CR-3."
19. EES-99-014, Revision 0, "Assessment of USI A-46 Safe Shutdown Equipment List (SSEL)."

Precursor Cards:

20. PC 99-0190, Corrective Action Steps for resolution of USI A-46 commitments
21. PC 97-7423, Unconservative Error In Calculation
22. PC 97-8769, "Bad Actor" relay validation

Other:

23. Operability Concern Report (OCR) 98-0001
24. "Structural Analysis," by Harold I. Laursen, ©1969, published by McGraw-Hill, Inc., Page 112.
25. Calculation identified by Work Order 4203-00, "FPC Crystal River Cable Tray Seismic Supports"
26. FPC Drawing 214-121, "Electrical Cable Tray Hanger Details"
27. Administrative Instructions (AI) 402C, "AP And EOP Verification And Validation Plan," Revision 9.
28. Surveillance Procedure (SP) 807, "Mounted Emergency Battery-Powered Light Units," Revision 15.
29. Abnormal Procedure (AP) 961, "Earthquake," Revision 12.