

October 10, 2011

Ann Cole, Director Office of the Commission Clerk PSC Recording & Filing 2540 Shumard Oak Blvd Tallahassee, FL 32399

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In re: Docket No. 100437-EI Examination of the outage and replacement fuel/power costs associated with the CR3 steam generator replacement project, by Progress Energy Florida, Inc.

Dear Ms. Cole:

Enclosed for filing on behalf of Progress Energy Florida, Inc. are the following:

- Progress Energy Florida, Inc.'s Petition to Determine The Reasonableness and Prudence of its Decisions on the CR3 Steam Generator Replacement O7379-11 Project Leading up to the October 2, 2009 Delamination (original and 7 copies);
- 2. Testimony & Exhibits of Garry D. Miller (original and 15 copies); $O \gamma 38 11$
- 3. Testimony & Exhibits of Jon Franke (original and 15 copies); $O \gamma 3 \otimes 2 1$
- 4. Testimony & Exhibits of Alexander J. "Sasha" Weintraub (original and 15 copies);
- 5. Progress Energy Florida's Second Request for Confidential Classification
 Regarding Portions of the Testimony & Exhibits of Alexander J. "Sasha"
 Weintraub (original and 7 copies); and
- 6. Notice of Filing Affidavit in Support of Progress Energy Florida, Inc.'s Second Request for Confidential Classification (original and 7 copies).

Sincerely Alexander Glen

Enclosures cc: Certificate of Service

DOCUMENT NUMBER - DATE

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FPSC-COMMISSION CLERE

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Examination of the outage and replacement fuel/power costs associated with the CR3 steam generator replacement project, by Progress Energy Florida, Inc. DOCKET NO. 100437-EI Submitted for Filing: Oct. 10, 2011

PROGRESS ENERGY FLORIDA, INC.'S PETITION TO DETERMINE THE REASONABLENESS AND PRUDENCE OF ITS DECISIONS ON THE CR3 STEAM GENERATOR REPLACEMENT PROJECT <u>LEADING UP TO THE OCTOBER 2, 2009 DELAMINATION</u>

Progress Energy Florida, Inc. ("PEF" or the "Company"), pursuant to Order No. PSC-11-

0352-PCO-EI, issued August 23, 2011 in Docket No. 100437-EI, respectfully petitions the

Florida Public Service Commission ("PSC" or the "Commission") to examine and evaluate

PEF's decisions concerning the Crystal River Unit 3 ("CR3") Steam Generator Replacement

("SGR") Project leading up to the October 2, 2009 delamination, and find that PEF's decisions

were both reasonable and prudent. In support of this petition, PEF states:

I. PRELIMINARY INFORMATION.

1. The Petitioner's name and address are:

Progress Energy Florida, Inc. 299 1st Avenue North St. Petersburg, FL 33701

2. Any pleading, motion, notice, order, or other document required to be

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served upon PEF or filed by any party to this proceeding should be served

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 upon the following individuals:

 APA

 R. Alexander Glenn

 GCL

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II. PRIMARILY AFFECTED UTILITY.

3. PEF is the utility primarily affected by the proposed request. PEF is an investorowned electric utility, regulated by the Commission pursuant to chapter 366, Florida Statutes, and is a wholly owned subsidiary of Progress Energy, Inc. The Company's principal place of business is located at 299 1st Avenue North, St. Petersburg, Florida 33701.

4. PEF serves approximately 1.6 million retail customers in Florida. Its service area comprises approximately 20,000 square miles in 35 of the state's 67 counties, encompassing the densely populated areas of Pinellas and western Pasco Counties and the greater Orlando area in Orange, Osceola, and Seminole Counties. PEF supplies electricity at retail to approximately 350

communities and at wholesale to Florida municipalities, utilities, and power agencies in the State of Florida.

III. PETITION SUMMARY.

5. PEF spent five years and tens of thousands of man hours carefully planning the CR3 Steam Generator Replacement ("SGR") Project. The Company reviewed the work of other utilities that had performed SGR projects and applied lessons learned from those projects to the CR3 SGR project. PEF sent engineers to other SGR projects underway to help the Company in better planning, designing, and implementing its own SGR project. PEF carefully and appropriately carried out the CR3 SGR project in accordance with its plan.

6. PEF selected qualified contractors to perform the work. The Company's contractors applied industry standard models, used in every other SGR project performed to that date, to determine how to create the opening in the containment building through which the steam generators would be replaced. And they applied industry accepted equipment and procedures to construct the opening.

7. Nothing the Company could have done, based on what management knew or should have known at the time, would have prevented the delamination and subsequent extended outage. As PEF's subsequent analysis showed, the delamination could not have been predicted using industry standard models and experience at the time, and was the product of unique circumstances, which neither PEF nor its contractors could have foreseen prior to the event. This is underscored by the fact that it took a world class team of several PhDs and other industry subject matter experts months, using data obtained *from* the delamination event itself, and developing new computer analyses running on super-computers, to determine how and why the delamination occurred. The U.S. Nuclear Regulatory Commission ("NRC") agreed. Following

months of detailed review by a NRC Special Inspection Team, the NRC found no issues with PEF's SGR project management, and no violations of NRC regulations.

8. At the same time immediately following the delamination, the Company's Fuels, System Planning, and Power Generation organizations took action to secure the least cost replacement fuel and power for the benefit of our customers, perform additional, preventive maintenance on key power plants to ensure their availability in the event of an extended outage, and locked up generation and transmission capacity to meet system requirements where economic to do so.

9. Simply put, this event took the entire industry by surprise, and has fundamentally changed the way the industry analyzes post-tensioned, pre-stressed concrete structures. This event could not have been reasonably foreseen based on what the Company knew at the time of the CR3 SGR project. PEF is therefore requesting a determination that the Company's decisions on or associated with the SGR project leading up to the October 2, 2009 delamination were reasonable and prudent.

IV. BACKGROUND.

10. CR3 is a Babcock & Wilcox ("B&W") designed pressurized water nuclear reactor ("PWR") with a post-tensioned, pre-stressed 42-inch concrete containment building surrounding and supporting a 3/8-inch thick carbon steel liner. The CR3 containment building is reinforced by an outer layer of steel rebar matting and steel tendons. The tendons consist of parallel steel wires, greased and enclosed in steel sleeves or conduits, running vertically and horizontally throughout the containment building, and located about ten inches inside the building wall concrete from the outer surface. There are 144 vertical tendons and 282 horizontal tendons located around the building. The purpose of the tendons is to strengthen the containment

building when the tendons are tightened through a process called tensioning. The tensioning occurred in 1976 following the initial construction of the CR3 containment building. There are a total of 69 operating PWR plants in the United States and 32 of them are post-tensioned concrete containment buildings with steel liners like CR3. Although each PWR is unique, CR3 does have several "sister" units that are similar in design to CR3. These include Oconee Units 1-3 operated by Duke Energy, Three Mile Island ("TMI") owned by Exelon, and Arkansas Nuclear Unit One ("ANO 1") operated by Entergy.

11. A PWR includes a Primary and Secondary System. The Primary System is located within the containment building and includes the reactor vessel, pressurizer, once through steam generators ("OTSGs"), primary coolant system, and related equipment. Within the Primary System, heat from the nuclear reactor is removed by water flowing through pipes between and around the fuel rods in the reactor vessel that then travels from the reactor vessel to the OTSGs where the heat is transferred from the reactor coolant system to a physically separated Secondary System, producing steam in the Secondary System. The steam in the Secondary System flows through the steam turbine which turns the generator to produce electricity.

12. The CR3 nuclear unit was placed in service in 1977 with two 1970's vintage Babcock & Wilcox OTSGs. The OTSGs are massive pieces of equipment weighing 500 tons each, and standing about 73 feet tall and approximately 12 feet in diameter (15 feet with shop installed piping). The original OTSGs were initially expected to last 40 years or about the same period as the initial CR3 operating license. As has been common with OTSGs, PEF experienced significant stress corrosion and cracking in the OTSG tubes that required an increase in tube inspections and repair activities. In addition to increasing operation and maintenance ("O&M")

costs, the stress corrosion and cracking shortened the useful life of the steam generators. Consequently, PEF determined that the OTSGs needed to be replaced. PEF initiated a multi-year project to analyze and eventually replace the OTSGs during the CR3 2009 refueling outage (the "R16" refueling outage) with new OTSGs manufactured with improved, corrosion-resistant materials. This was the SGR project.

V. THE SGR PROJECT.

13. PEF's SGR project team spent years extensively studying industry experience regarding steam generator replacements that other companies had performed. At the time PEF was planning the SGR project, CR3 was the fifth of a group of similar B&W nuclear power plants that replaced steam generators and was one of dozens of other non-B&W nuclear power plants that replaced steam generators. PEF benchmarked its SGR project against these other industry SGR projects incorporating lessons learned and best practices into its SGR project.

14. With the assistance of independent experts, PEF performed studies on how to best replace the OTSGs at CR3. PEF discovered that the most common method for replacing steam generators at plants like CR3 was to create an opening in the containment wall that surrounds the plant and move the steam generators out and in through that containment opening. Eleven PWR plants had similar projects prior to the CR3 SGR project where they successfully created and restored temporary construction openings in their containment building walls to replace their steam generators or reactor vessel heads prior to the CR3 SGR project. This included some of the CR3 "sister units." For example, ANO 1 successfully completed a steam generator replacement project in 2005 by removing and replacing the steam generators through a construction opening cut in the containment wall. Exelon also successfully replaced its steam

generators at TMI by creating a construction opening through the containment wall in late October 2009, shortly after the SGR project work started at CR3.

15. PEF and its team of experts determined that the creation of a construction opening in the CR3 containment building wall was the best option to replace the OTSGs at CR3. There were only two options for CR3: (1) replacing the OTSGs through a construction opening in the CR3 containment wall; or (2) replacing them through the existing equipment hatch. The original OTSGs were not installed through the equipment hatch. They were installed when there was no roof, no wall where the equipment hatch now exists, and no concrete on the building. The equipment hatch was designed to transfer some items in and out of the CR3 containment building, but it was not designed to accommodate moving through the hatch large pieces of equipment like the OTSGs, which at the time of construction were expected to last the entire 40year life of the plant.

16. The CR3 equipment hatch was located below the containment building operating deck where a vast amount of equipment, structures, cables, conduit, and piping are installed. These would have to be removed to move the old OTSGs out and the new OTSGs into the containment building using the equipment hatch and then they would have to be re-installed or replaced. By creating a temporary construction opening above the CR3 operating deck, PEF avoided these interferences. PEF and its team of experts determined that the creation of a temporary construction opening at CR3 above the operating deck presented far less risk, cost less to perform, and exposed workers to much less radiation than using the equipment hatch to replace the OTSGs at CR3. Other nuclear power plants with equipment hatches located below the operating deck like CR3 had determined that the best option to replace the steam generators was through a temporary construction opening created above the operating deck. This was a

common practice in the industry to replace steam generators (or reactor vessel heads); utilities had successfully created and restored temporary construction openings in their containment walls at eleven nuclear power plants prior to the CR3 SGR project. As a result of its extensive analysis of the options for replacing the OTSGs at CR3, PEF concluded that the creation of a temporary construction opening in the CR3 containment building to move the old OTSGs out and the new OTSGs into the building was the best option.

17. PEF analyzed project management alternatives for the SGR project and, after performing a risk and cost-benefit analysis for each option, PEF determined that the selfmanagement project option was superior for the SGR project. The Company had prior experience with steam generator replacements at the Progress Energy Harris nuclear power plant. PEF further assembled a team of engineers and contractors for the SGR project that included experienced companies and personnel from other steam generator replacement projects. The Company selected experienced, industry experts for all major contract activities on the SGR project, including engineering, construction management, craft labor, heavy lifting, hydrodemolition, liner plate removal and restoration, cutting and welding, and replacement steam generator manufacturing. PEF further retained independent, third-party review services for different aspects of the SGR project. As a result, PEF had the experienced and skilled resources needed to perform the SGR project. PEF also employed the same project management policies and procedures on the SGR project that PEF employed on other major capital projects.

18. After more than five years of detailed planning, analysis, and extensive design and engineering work, PEF and its team of industry experts began work on the SGR project in September 2009. The SGR project work scope involved creating a construction opening in the

CR3 containment building wall above the existing equipment hatch to establish a transport path for the removal and replacement of the OTSGs. The project also involved cutting the piping connections of the existing OTSGs and removal of the OTSGs from their constraints within the containment building, removing the OTSGs from the building using a temporary crane and rigging transport system, and then moving the new OTSGs into the containment building using the same transport system. The new OTSGs were then installed inside the containment building and the piping connections welded. The final step was to close the temporary construction opening in the CR3 containment building.

19. PEF commenced work to create the temporary construction opening in the CR3 containment building. To create the temporary construction opening in the CR3 containment building, the tendons located in the proposed opening had to be de-tensioned and removed. PEF's tendon contractor de-tensioned the horizontal and vertical tendons that traversed the proposed temporary construction opening in order to remove them from the proposed opening in the containment wall. The concrete in the temporary construction opening was removed with high pressure water nozzles. The next steps were to remove the outer steel rebar, remove the detensioned tendons in the construction opening, and continue concrete removal down to the carbon steel liner. The steel liner was then cut to create the opening into the building. On the SGR project, the tendons in the temporary construction opening in the containment wall were detensioned and hydro-demolition was underway to remove the outer layer of concrete down to the steel rebar. The steel rebar was cut, and hydro-demolition continued to remove the concrete to the tendon conduit. During this period of hydro-demolition the workers observed water flowing from a crack below and to the right of the temporary construction opening. An inspection was initiated and the delamination was discovered.

VI. THE OCTOBER 2, 2009 DELAMINATION.

20. PEF discovered the delamination on October 2, 2009. The delamination was a separation of the concrete in the wall in one of the bays (Bay 3-4) of the CR3 containment building. The separation was as little as 1/64 inch up to about 2 inches around the temporary construction opening. The delamination occurred approximately ten inches from the outside concrete wall and the delaminated area remained connected to the remaining 30+ inches of concrete in the containment building. The delamination occurred only in Bay 3-4. Extensive testing showed that the delamination did not occur in any other walls or bays of the CR3 containment building.

21. Once PEF discovered the delamination, PEF notified the NRC and PEF commenced a root cause investigation in accordance with its existing internal policies and procedures and NRC and industry standards. PEF assembled a world class team of industry experts including industry peers from around the country to assist in the root cause investigation. The mission of the root cause investigation team was to determine the technical root cause of the wall delamination and the "programmatic" root cause, or what program or organizational factors caused or contributed to the delamination; what could be done to repair the delamination; and what could be done to prevent its recurrence.

22. The NRC also sent a Special Inspection Team to the CR3 site to remain on site and independently review the delamination, PEF's actions leading up to the delamination, and PEF's response to the delamination, including its root cause investigation and assessment. The NRC Special Inspection Team inspectors issued their own report on the Company's root cause investigation. The NRC inspectors concluded that the Company's root cause investigation of the CR3 containment wall delamination on October 2, 2009 was comprehensive and thorough and

that it complied with the Company's standard Corrective Action Program ("CAP") procedures consistent with NRC requirements. They found no violations. The NRC inspectors further concluded that the October 2, 2009 delamination was not a threat to public safety.

23. The Company's root cause investigation and assessment determined that the causes of the October 2, 2009 wall delamination were unprecedented, unpredictable, and, therefore, unpreventable. Utilities at several other similar nuclear power plants had cut temporary construction openings in their containment structures to replace steam generators or reactor vessel heads before PEF cut a containment opening for the OTSGs on the SGR project. PEF used the same industry standard engineering analyses and construction methods to create the construction opening on the SGR project that the other utilities used and none of the other utilities experienced a delamination on their projects. PEF also employed experienced engineers and construction methods to plan for and implement the construction opening for the OTSG replacement on the SGR project. Application of these industry standard engineering and construction analyses and methods did not predict or reveal the delamination that occurred at CR3 before it occurred.

24. The failure of the industry standard engineering modeling analyses and calculations to predict the CR3 wall delamination was the programmatic root cause of the delamination. The Company's root cause investigation and assessment determined that the engineering analyses and calculations supporting the CR3 containment wall opening work on the SGR project were performed in accordance with industry standards. The delamination in fact could not be simulated and the technical causes of the delamination determined using the then existing industry standard engineering modeling analyses and calculations. The necessary

corrective action to repair the delamination and prevent its recurrence required the development of new engineering modeling analysis changes to create first-of-a-kind, state-of-the-art engineering models to accurately simulate and, therefore, predict the delamination. These engineering models incorporated information obtained *from* the delamination that was learned only during the root cause investigation. Due to what PEF now knew were inherent limitations in the industry standard engineering analytical and modeling methods, PEF did not and could not foresee the October 2, 2009 delamination that occurred on the SGR project.

25. The NRC Special Inspection Team inspectors independently reviewed the results of the Company's root cause investigation and assessment of the October 2, 2009 delamination. These NRC inspectors concluded in their report that the October 2009 delamination was unprecedented. They also concluded that the technical contributing causes of the delamination discovered with the application of the first-of-a-kind engineering models developed during the root cause investigation were reasonable and adequately supported by the evidence. The NRC further agreed that the corrective actions developed and taken by the Company were appropriate and addressed the causal factors of the delamination. The NRC Special Inspection Team report supports the Company's determination that the October 2009 delamination was unprecedented and unpredictable.

VII. SUPPORTING TESTIMONY.

26. PEF's petition is supported by the following testimony:

JON FRANKE:	Reasonableness and prudence of PEF's SGR Project decisions from the creation through the execution of the SGR project;
GARRY MILLER:	Reasonableness and prudence of PEF's root cause investigation and assessment: and

SASHA WEINTRAUB: Reasonableness and prudence of PEF's fuel purchases & purchase power replacement costs associated with the extended outage at CR3.

PEF's testimony and exhibits, filed together with this Petition, demonstrate the reasonableness and prudence of PEF's decisions on the SGR project leading up to the delamination on October 2, 2009.

VIII. FUEL AND REPLACEMENT POWER COSTS.

27. PEF has met peak load and reserve margin requirements during the extended CR3 outage through Company-owned generation and replacement power purchases. Actual gross fuel and replacement costs incurred as a result of the extended outage due to the October 2009 delamination through August 31, 2011 total \$438,976,648.

28. PEF's Fuels and System Planning Departments were tasked with ensuring that PEF had ample load and capacity resources to supply the electrical needs of its customers. To accomplish this, economic and operational feasibility analyses were performed. Fuel requirements and supply capacity were studied, risks were evaluated, contingency plans were put in place, and potential economic power market opportunities were identified. The Fuels Group adequately solicited the market to determine if there were opportunities to secure electric energy below PEF's estimated generation cost to replace lost generation due to the outage. Decisions were made based on economic viability using forecasted load and resource profiles. PEF's Fuels and System Planning operations continued to monitor the overall status and timing of CR3's return to service and make reasonable and prudent decisions with respect to replacement power and fuel during the extended CR3 outage.

29. Damages for the CR3 delamination event have been partially recovered through insurance claims filed with Nuclear Electric Insurance Limited ("NEIL"). PEF's insurance

policy with NEIL provides coverage for the October 2009 delamination as defined in the insurance policy. Certain costs to repair the containment building and costs to purchase additional fuel and replacement power during the extended CR3 outage are expected to be offset by insurance payments after PEF's deductible was applied. PEF reasonably and prudently incurred \$438,976,648 in replacement fuel and power costs through August 31, 2011 during the CR3 unit extended outage before applying any NEIL insurance proceeds. The expected reimbursement to be received from NEIL based on submitted claims for the period from April 9, 2010 through August 31, 2011 is \$308,571,429. After deducting the expected NEIL reimbursements, the total net balance of reasonably and prudently incurred actual replacement power and fuel costs through August 31, 2011 is \$130,405,219.

IX. DISPUTED ISSUES OF MATERIAL FACT.

30. PEF is not aware at this time that there will be any disputed issues of material fact in this proceeding. Through its testimony and exhibits, PEF expects to demonstrate that all of its decisions on the SGR project leading up to the October 2, 2009 delamination were both prudent and reasonable.

X. CONCLUSION.

31. PEF seeks an affirmative determination that all of PEF's decisions on or associated with the SGR project leading up to the October 2, 2009 delamination were reasonable and prudent.

WHEREFORE, for all the reasons provided in this petition, as developed more fully in PEF's simultaneously filed testimony and exhibits, PEF respectfully requests that the PSC determine that all of PEF's decisions on or associated with the SGR project leading up to the October 2, 2009 delamination were reasonable and prudent.

Respectfully submitted this 10th day of October, 2011.

R. Alexander Glenn

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CERTIFICATE OF SERVICE

I HEREBY CERTIFY a true and correct copy of the foregoing has been furnished to counsel and parties of record as indicated below via electronic and U.S. Mail this 10th day of October, 2011.

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