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Duke Energy Florida, Inc.

February 10, 2014

Ms. Carlotta Stauffer, Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

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COMMISSION
CLERK

Re: *Petition of Duke Energy Florida, Inc., to Modify Scope of Existing Environmental Compliance Program; Docket No. 130301-EI*

Dear Ms. Stauffer:

Please find enclosed for filing on behalf of Duke Energy Florida, Inc. ("DEF"), DEF's Response to Staff's First Data Request (Nos. 1-33).

Also, attached for filing is DEF's Request for Confidential Classification of certain information contained in DEF's Crystal River South (Units 1 and 2) Environmental Compliance Study ("Compliance Study").

Thank you for your assistance in this matter. Please feel free to call me at (850) 521-1428 should you have any questions concerning this filing.

Respectfully,

Matthew R. Bernier
Sr. Counsel

Matthew.Bernier@duke-energy.com

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**DUKE ENERGY FLORIDA, INC.'S RESPONSES TO
STAFF'S FIRST DATA REQUEST (NOS. 1-33)
Docket No. 130301-EI**

For questions 1 and 2, please refer to Page 53261 of Federal Register Vol. 78, No. 168, which states:

On May 2, 2013, FDEP supplemented Florida's regional haze SIP with an April 30, 2013, letter from Duke Energy (formerly known as Progress Energy) notifying FDEP of the Company's binding decision to pursue Option 1 under the Crystal River BART construction permit and shut down Units 1 and 2 by December 31, 2020.

1. In addition to Option 1, mentioned above, please summarize all options evaluated by DEF which led to the April 30, 2013, letter being sent to DEP.

Response:

Air Permit No. 017004-036-AC issued by the FDEP to DEF contains two scenarios that relate to the operation of Crystal River Units 1 and 2 in compliance with the regional haze requirements. Scenario A (referred to as Option 1 above) requires the "discontinuation of operation of Units 1 and 2 as coal-fired units by December 31, 2020." The second, and only other option allowed by permit (referred to as Option B in the permit), requires the installation and operation of air pollution control equipment (scrubbers and FGD) on Units 1 and 2 by 2018, in order to meet emissions limits required by the permit. This alternative was discussed in Duke's Review of Clean Air Compliance Plan filed on April 1, 2013 Exhibit No. __ (PQW-1).

2. Please provide DEF's April 30, 2013, letter to DEP notifying DEP of the Company's binding decision to shut down Crystal River Units 1 and 2 by December 31, 2020.

Response:

Please see attached April 30, 2013 letter. Please note that the commitment, as required by the permit, is to cease coal-fired operation of Units 1 and 2 by December 31, 2020.

For questions 3 through 6, please refer to DEF's 2013 Review of Integrated Clean Air Compliance Plan filed on April 1, 2013, in Docket No. 130007-EI¹ (2013 Compliance Plan).

3. On page 24 DEF discusses many factors that were considered in its evaluation of retiring CR 1 and 2. Please describe, in detail, the following factors:
- a. Construction Risk
 - b. Facility Age and Condition
 - c. Long-term Operability

Response:

"Construction Risk", as used in the referenced document, addresses the cost uncertainty and execution risks associated with selecting and pursuing a major construction project at an older existing plant facility like Crystal River 1 and 2. Variability in the condition of existing components may affect the cost and specific plans for reconditioning, modifications, or upgrades which may not be finalized until the project is underway. Routing of new above and below ground utilities can be complicated by existing systems and lines that may have been abandoned in

¹ Exhibit PQW-1.

place earlier in the lifecycle of the facility. Working conditions can be challenging at an older facility on a site where the physical layout is very tight making major modifications more challenging than they would be at a newer facility, like Crystal River 4 and 5, which had original provisions in the site planning and systems design for the type of upgrades being considered. These challenges lead to cost uncertainty and execution risk which can be more difficult to accurately identify and quantify.

“Facility Age and Condition”, as used in the referenced document, reflects on the normal condition of facilities as they age, and the number of components that may need to be upgraded or replaced when a plant life extension is considered which is significantly beyond the expected facility life, as would be the case with the 25 year life extension analyzed in this evaluation.

“Long Term Operability”, as used in the referenced document, considers the costs and uncertainty of adapting ageing facilities to continue operating to meet new requirements and/or regulatory limits as well as the likelihood that over a longer extended operating period there would be significant additional changes in operating requirements in the future.

4. On page 24 DEF states that, “the current condition of the units (Crystal River Units 1 and 2) are not conducive to continued operations for an additional 25 years.” Please describe in detail the specific conditions that are not conducive to the continued operation of Crystal River Units 1 and 2.

Response:

The document referenced states that, “While the project estimates provided funding for plant modernization, the units would be nearing 50 years of age by the time the projects would be completed and the current condition of the units are not conducive to continued operations for an additional 25 years.” Normal ageing and wear and tear have a cumulative effect over time on the power generation systems (e.g. boilers, turbine generators, balance of plant equipment and control systems), transmission systems and infrastructure (e.g. fuel handling systems, cooling water systems and plant structures) at a coal fired power plant in the age range of Crystal River Units 1 and 2. As the plant has operated over time, these systems were maintained and upgraded in a manner commensurate with the expected remaining life of the facility. The reference to “the current condition of the plant” is a reflection on the age and general condition of the facility, and is not intended to refer to specific conditions.

5. On page 24 DEF states that, “the physical layout [of Crystal River Units 1 and 2] is very tight and construction of the emissions control systems would be quite involved and would require extensive unit outages to accommodate the removal of most of the ducts, fans and stacks beyond the air heaters.” In addition to the extensive unit outages, are there any other risks associated with the removal of the ducts, fans and stacks beyond the air heaters?
 - i. If yes, please describe these risks.
 - ii. Will the physical layout impact DEF’s proposed DSI and ACI systems? Please explain answer.

Response:

i. There are many risks associated with the required physical layout of the new emission control systems at Crystal River Units 1 and 2 analyzed in the referenced document. The area between the air heater outlets and the waterfront intake structures is quite limited, and all of the existing precipitators and fans would need to be removed to provide space for erection of the new equipment. The constrained (tight) physical layout of the plant provides very little space and tight clearances for layout and erection of new equipment, maneuvering large construction equipment during erection and clearances required to avoid potential contact with existing structures. The cooling water intake structures and large underground concrete intake piping systems are also located in that same area, and present additional risks associated with potential damage due to the movement, loading and foundation excavation activities required for the anticipated construction activities.

ii. Unlike the large replacement systems required for the full scrub and life extension scenario, the DSI and ACI systems proposed for limited continued operation are much smaller systems and can be located in open areas which are available around the existing equipment. None of the fans or precipitators will need to be removed or relocated, so the construction impacts and installation risks should be minimal.

6. On page 21 DEF states that:

the viability and cost of the options for bridge power purchases, transmission system requirements, limited continued Crystal River Units 1 and 2 operations and new generation are all being considered

to establish a reasonable path forward to ensure cost effective and reliable service. Once these investigations have been completed, a recommendation for the planned retirement date for the Crystal River Units 1 and 2 units will be finalized.

Has the investigation discussed in DEF's statement been finalized? If yes, please provide a summary of the results of the investigation.

Response:

The investigation discussed in the document referenced above has been finalized.

A summary of the results is provided in the attached confidential document entitled "*Duke Energy Florida, Crystal River South (Units 1 and 2) Environmental Compliance Study Addendum: CR South Limited Continued Operation, Internal Study Prepared By: Strategic Engineering, December 2013.*"

7. Assuming Crystal River Units 1 and 2 are retired in 2016, please list in a format similar to Table 3.3 of DEF's 2013 Ten-Year Site Plan, required transmission projects.

Response:

See attachment responsive to question 7-Table 3.3.

8. Assuming Crystal River Units 1 and 2 are retired in 2020, please list in a format similar to Table 3.3 of DEF's 2013 Ten-Year Site Plan, required transmission projects.

Response:

If replacement generation is not in the Crystal River area then the same transmission projects are needed as Q7.

If replacement generation is in the Crystal River area then no transmission projects are necessary.

9. Please complete the table below summarizing the emission limits set by MATS. Please identify and add any limits or requirements not included in the table that are required by MATS.

		Limit	Averaging Period
Hg	lbs/Tbtu		
NOx	lbs/MMBtu		
SO2	lbs/MMBtu		
Filterable PM	lbs/MMBtu		

Response:

		Limit	Averaging Period
Hg	lbs/Tbtu	1.0	90 days
HCl	lbs/MMBtu	0.0020	30 days
NOx	lbs/MMBtu	NA	
SO2	lbs/MMBtu	NA	
Filterable PM	lbs/MMBtu	0.030	30 days

10. Please complete the table below summarizing the emission limits set by CAVR. Please identify and add any limits or requirements not included in the table that are required by CAVR.

		Limit	Averaging Period
Hg	lbs/Tbtu		
NOx	lbs/MMBtu		
SO2	lbs/MMBtu		
Filterable PM	lbs/MMBtu		

Response:

		Limit	Averaging Period
Hg	lbs/Tbtu	NA	
NOx	lbs/MMBtu	0.09*	30 days
SO2	lbs/MMBtu	0.15*	30 days
Filterable PM	lbs/MMBtu	0.015*	3-hour stack test
Filterable PM	lbs/MMBtu	0.04**	3-hour stack test

* Required permit limits (by 2018) if the option to install air pollution controls was selected.

** Currently applicable permit limit for BART. Limit is based on a weighted average between the two units.

11. Please complete the table below summarizing the current emission levels of Crystal River Units 1 and 2. In this context, please identify and add any relevant emissions not included in the table.

		Current Emission Levels	Averaging Period
Hg	lbs/Tbtu		
NOx	lbs/MMBtu		
SO2	lbs/MMBtu		
Filterable PM	lbs/MMBtu		

Response:

		Current Emission Levels	Averaging Period
Hg*	lbs/Tbtu	3.3	3 hour stack test (2013)
NOx	lbs/MMBtu	0.389 (Unit 1) 0.288 (Unit 2)	Annual Average (2013)
SO2	lbs/MMBtu	1.5	Annual Average (2013)
Filterable PM	lbs/MMBtu	0.038 (Unit 1)** 0.008 (Unit 2)**	3 hour stack test (2013)
HCl	lbs/MMBtu	0.085	

* No current mercury limit. Results based on recent stack test burning CAPP coal.

** Based on 2013 annual compliance stack test.

12. Please complete the table below summarizing the projected emission levels of Crystal River Units 1 and 2 with the emission controls, proposed in DEF's Petition to Modify Scope of Existing Environmental Compliance Program (Petition),² in place. In this context, please identify and add any relevant emissions not included in the table.

² Filed on December 31, 2013, in the instant Docket.

Response:

		Projected Emission Levels (Units 1 & 2)	Averaging Period
Hg	lbs/Tbtu	2.2	90-day facility average
HCl	lbs/MMBtu	0.007	30-day facility average
NO_x	lbs/MMBtu	0.29	
SO₂	lbs/MMBtu	0.05	
Filterable PM	lbs/MMBtu	0.04	30-day average with Units 1 & 2

13. Please describe how the Projected Emission Levels, contained in DEF's response to question 12, were developed.

Response:

Hg and HCl projections were developed based on modeling of MATS compliance using facility-wide averaging. Unit 1 and 2 target emission levels, when averaged with the projected Units 4 and 5 emission levels, provide assurance with MATS compliance requirements on a facility-wide basis. NO_x and SO₂ projections are based on data continuously monitored during the 2013 Alternate Fuel Trials. The Filterable PM projection is based on required compliance with the current BART permit limit.

14. Please explain why the Projected Emission Levels, contained in DEF's response to question 12, are reasonable.

Response:

During the 2013 Alternate Fuel Trials, Hg and HCl emissions averaged less than the projected emission levels outlined in Question 13. While PM results during the 2013 Alternate Fuels Trials averaged above the projected target level, the planned ESP projects are anticipated to reduce Filterable PM emissions below the BART PM level when operating in a MATS compliant mode.

For questions 15 through 17, please refer to DEF's Petition.

15. On page 5 DEF states that:

based on the results of those evaluations and tests of alternate coals at CR 1 and 2, DEF has determined that the use of alternate coals with installation of less expensive pollution controls would provide a cost-effective means for DEF to continue operating CR 1 and 2 in compliance with MATS.

Please provide the results of the test and evaluations described in this statement.

Response:

Please see DEF's response to question 6.

16. On page 5 DEF states that, "DEF expects to incur annual O&M costs of approximately \$2 million while the new pollution controls remain in operation." Does DEF anticipate that the use of alternate coals will increase or decrease the fuel costs associated with Crystal River Units 1 and 2? Please explain.

a. If yes, please provide an approximation of the annual increase or decrease associated with the alternate coal.

Response:

When DEF evaluated the MATS compliance alternatives, it was assumed that the units would switch to the alternate coal(s) in the timeframe that MATS compliance requirements go into effect. If DEF chose to retire the units at that point, the fuel costs for Crystal River Units 1 and 2 would drop to \$0 and the system energy requirements would shift to economic dispatch of remaining available system resources and purchased power at that time.

Table 3.1 in the Study provided in response to Question 6 summarizes the results of the cost comparisons between these alternatives. While the overall cost for the limited continue operations alternative (Alternative 2) was found to be \$307 Million less expensive for customers based on Cumulative Present Value of Revenue Requirements (CPVRR), the specific portion of costs associated with “Fuel and other Variable Production Costs” was found to be \$56 Million higher on a CPVRR basis over the study period. This difference is driven primarily by the forecasted fuel prices for this portion of energy being served with alternate coal at Crystal River Units 1 and 2 in Alternative 2 versus natural gas in the available system resources in Alternative 1.

Note: In the study results provided in response to question 18, there are also annual values and differences listed for fuel costs between the alternatives. However, the costs of fuel associated with the purchased power in Alternative 1 are included in the “Other” category, so a direct comparison of annual values in these results tables is not representative. The study result referenced above from Table 3.1 would be the most applicable response to this question.

17. On page 5 DEF states that, “the less expensive pollution controls are estimated to be approximately \$28 million.” Please provide an itemized break down of the \$28 million estimate, by component. Please identify and include in this break down the components contained in Table B-1 of DEF’s 2013 Compliance Plan.

Response:

The components that are identified in Table B-1 of DEF’s 2013 Compliance Plan reflect the projected \$ 1.015 billion cost for installation of new flue gas scrubbers,

selective catalytic reduction systems and baghouses that would be needed for continued operations beyond 2020 under the Crystal River BART construction permit. The estimate of \$28 million for the proposed compliance configuration for limited continued operation is a small fraction of the costs included in Table B-1, and are for a much more limited equipment scope that will allow the units to continue operating in compliance with BART and MATS requirements during the interim period prior to 2020. The required projects are discussed in the study document attached in response to Question 6. The table contained in Appendix B of the referenced study provides a listing of the current planned projects that are included in the \$28 million estimate. Project cost estimates will be updated as the projects develop and are subject to change as scope and timing are refined.

For questions 18 through 21 please refer to page 4 of DEF's Petition which states that:

DEF compared the quantitative and qualitative merits of pursuing the following alternatives:

Alternative 1: Retire CR 1 and 2 in April 2016 before the MATS compliance deadline (assuming one year extension) and meet system requirements with purchased power and/or new resources in a manner that the grid would support.

Alternative 2: Establish a MATS compliance plan for CR South and configure the units to operate in compliance through mid-2018, and establish a resource plan to provide for replacement combined cycle generation in that timeframe. This alternative includes a competitive solicitation for combined cycle energy and capacity starting in 2018, identification of additional resources needed in 2016 and beyond, and a transmission plan that supports the required resources.

The results of the quantitative economic analysis indicate that the lifecycle projected system cost (CPVRR) for the option of limited continued operation of CR 1 and 2 through mid-2018 (Alternate 2) was \$307 million lower overall than the system CPVRR for the option retiring the units in mid-2016 (Alternate 1).

18. For Alternative 1 and 2, please complete the table below summarizing the results of DEF's quantitative economic analysis. Please present all values in \$M in \$2014.

	Generation	Transmission	Fuel	O&M	Other	Total	Bill Impact \$/1,000 kWh (Nominal)
2014							
2015							
2016							
2017							
2018							
2019							
2020							
2021							
2022							
2023							
2024							
2025							
2026							
2027							
2028							
2029							
2030							
2031							
2032							
2033							
2034							
2035							
2036							
2037							
2038							
2039							
2040							
2041							

Response:

Please see attached table responsive to questions 18, 19, 20, 21, and 31 - tabbed Question 18.

19. For Alternative 1 and 2, please complete the table below summarizing DEF's projected generation expansion plan.

	Generation Additions	Generation Retirements
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
2036		
2037		
2038		
2039		
2040		
2041		

Response:

2020								
2021								
2022								

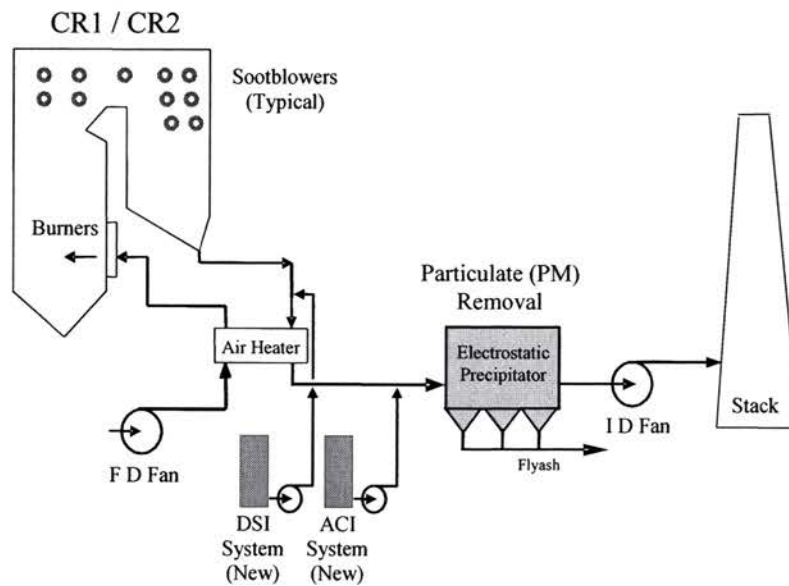
Response:

Please see attached table responsive to questions 18, 19, 20, 21, and 31- tabbed Question 21.

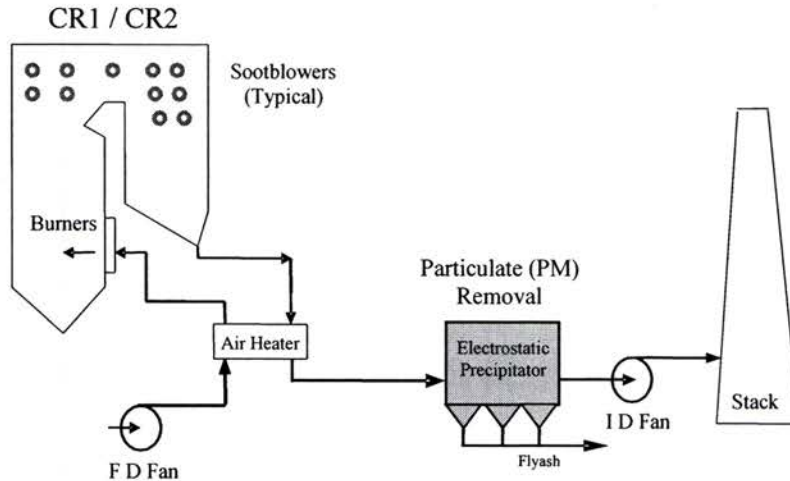
22. Please provide a simplified diagram of Crystal River Units 1 and 2 with and without the emission control projects proposed in the Petition.

Response:

Please see the Diagram below with the proposed new emission control systems:



Please see the Diagram below without the proposed new emission control systems:



23. Please identify, with pinpoint citation, all rules and/or regulations upon which DEF is basing its Petition.

Response:

DEF is basing its Petition on complying with the requirements of two federally driven regulatory programs, which are the Mercury and Air Toxics Standards (MATS) rule and the Regional Haze Rule. The Regional Haze Rule, which is implemented by the State of Florida through its own rule, contains requirements to comply with Best Available Retrofit Technology (BART) and Reasonable Further Progress (RFP) in order to meet visibility goals in national parks and wilderness areas. The regulatory citations for these requirements are:

MATS: Code of Federal Regulations (CFR) Part 63, Section 63.9991 (40 CFR 63.9991)

BART and RFP: Federal: 40 CFR 51.308; State of Florida: Florida Administrative Code (FAC) 62-296.340

24. With respect to DEF's CPVRR analysis presented in its Petition, please identify the source(s) used to develop its fuel forecast and any environmental forecasts.

Response:

DEF's natural gas and oil forecasts for the first three years are based on the NYMEX Forward Price curve. Long term natural gas and oil forecasts are based on forecasts provided by Energy Ventures Analysis (EVA), a nationally recognized consultant firm based in Arlington, VA. DEF's coal price forecast for CR4&5 is developed based on the forward market price for the first three years and on an EVA forecast for the long term. For coal to be burned at CR1&2 during the MATS compliance period, DEF uses coal price quotes from a variety of mines identified as potential sources for alternative coal. These quotes were used to generate a consensus price forecast for 2016 – 2020. DEF's forecast of carbon emissions is based on past potential legislation creating a market price for carbon. Start dates for carbon price implementation have been extended to allow for implementation following a future election cycle.

25. With respect to DEF's CPVRR analysis presented in its 2013 Compliance Plan, please identify the source(s) used to develop its fuel forecast and any environmental forecasts.

Response:

The price forecast used in the Compliance Plan was the same forecast used in developing the petition (see response to question 24) with the exception that coal

prices for Crystal River Units 1 and 2 were based on the forward market price and EVA forecasts as described for Units 4 and 5 in response to question 24.

26. Please provide a milestone schedule for the ACI system proposed in DEF's Petition.

Response:

<u>Milestone</u>	<u>Crystal River 1</u>	<u>Crystal River 2</u>
Engineering & design	3/1/15	8/1/14
Installation	6/1/15	11/1/14
Parametric testing	7/1/15	1/1/15
Completion of reagent systems	8/1/15	2/1/15

27. Please provide a milestone schedule for the DSI system proposed in DEF's Petition.

Response:

Please see DEF's response to question 26.

28. Please provide a milestone schedule to change the ESPs proposed in DEF's Petition.

Response:

<u>Milestone</u>	<u>Crystal River 1</u>	<u>Crystal River 2</u>
Phase I engineering & design	3/1/15	8/1/14
Phase I installation	6/1/15	11/1/14
Completion of phase I projects	8/1/15	2/1/15

Phase II engineering & design	10/1/15	10/1/15
Phase II installation	12/1/15	12/1/15
Completion of phase II projects	2/1/16	2/1/16

29. Other than the proposed projects, did DEF evaluate any alternatives that would allow DEF to operate CR 1 and 2 in compliance with MATS through mid-2018?
- a. If yes, please describe the other alternatives and why they were not chosen.
 - b. If no, please explain why not.

Response:

In addition to the proposed projects, DEF also initially considered conversion of the Crystal River Units 1 and 2 boilers to fire natural gas or to blend western subbituminous coals with western bituminous coals during the MATS compliance period. For the natural gas option, the estimated boiler conversion costs were much higher than the costs associated with the current proposed projects, and the nuclear licensing requirements associated with routing the natural gas lines in close proximity through the generation complex presented significant feasibility concerns. For the coal blending option, since the boilers and fuel handling systems were not originally designed and permitted for subbituminous coals, the additional costs and operational risks associated with handling and firing these more volatile coals outweighed the potential benefits of blending lower priced coals over the short period of interest. The compliance plan selected by DEF was favorable on both a cost basis and a risk basis to these other alternatives.

30. On page 5 of the Petition, DEF states that:

the qualitative planning assessment concluded that the limited continued operations alternative (Alternative 2) has a significant positive impact on system reliability if operations of CR 1 and 2 are continued until replacement generation can be added near Crystal River, or until transmission projects can be completed to address grid concerns.

Please identify and describe the “significant positive impact[s]” and “grid concerns” referenced in this statement.

Response:

DEF determined that the large generation deficits resulting from removal of Crystal River Units 1 and 2, coupled with replacement power flowing from central Florida would result in significant changes in system power flows. It was also determined that a number of significant transmission system projects could be deferred if the Crystal River 1 and 2 units were to remain in service during the interim period, and eliminated if replacement generation were constructed at or near the Crystal River site. At the Company’s request, the Florida Reliability Coordinating Council (FRCC) performed a transmission study of these conditions which confirmed the reliability concerns (e.g., “grid concerns”) identified by DEF associated with retirement of the CR South units in 2016, and identified significant transmission system upgrades that would be required for DEF and adjacent systems. The FRCC studies also confirmed that continued operation of Crystal River Units 1 and 2 would resolve these issues on the DEF system and adjacent systems (“significant positive impacts”) during this period, and that new generation built at or near the Crystal River site would continue to provide these “positive” benefits to the system once Crystal River Units 1 and 2 were shut down. These assessments are addressed in more depth in Section 3 in the Study attached in response to Question 6.

31. Please complete the table below summarizing the projected impact the proposed projects will have on ECRC and Fuel factors.

	ECRC Factor Impact \$/1,000 kWh	Fuel Factor Impact \$/1,000 kWh
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		

Response:

Please see attached table responsive to questions 18, 19, 20, 21, and 31- tabbed Question 31.

32. How does DEF intend to recover the capital costs associated with the proposed projects while CR 1 and 2 are still in-service?

Response:

DEF intends to recover both capital and O&M costs associated with the CR1 &2 MATS compliance projects through the ECRC consistent with how other ECRC project costs are recovered through the clause. DEF intends to recover a return on

average net investment along with depreciation expense and property taxes on capital project costs (once these assets are placed in-service) and recover O&M costs as incurred. Any unrecovered costs at CR1&2 retirement will be recovered as indicated in the response to Q33.

33. How does DEF intend to recover the unrecovered portion of the capital costs associated with the proposed projects after CR 1 and 2 are retired?

Response

DEF intends to recover any unrecovered costs associated with the CR1&2 MATS compliance projects at CR1&2 retirement through the ECRC over a 3 year amortization period. This is consistent with how the Commission approved recovery of the expected unusable NOx allowances in Docket No. 1100007-EI, Order No. PSC-11-0553-FOF-EI and Thermal Discharge Compliance Project costs in Docket No. 130091, Order No. PSC-13-0381-PAA-EI. DEF will record a regulatory asset for the unrecovered costs, establish a three year amortization recovery schedule and earn a return on the unamortized balance of the regulatory asset during the recovery period.

REDACTED



Duke Energy Florida

Crystal River South (Units 1 and 2) Environmental Compliance Study
Addendum: CR South Limited Continued Operation

[CONFIDENTIAL: For Internal Use]

Internal Study Prepared By:

Strategic Engineering
December 2013



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Executive Summary

Duke Energy's subsidiary, Duke Energy Florida, Inc. (DEF or the Company), owns and operates four large coal-fired units at the Crystal River Energy Complex (CREC), which is a large generation complex in coastal west central Florida. Commercial operations at the Energy Complex began in 1966 with Unit 1, and continued to develop through the mid-'80's when the two newest units (Units 4 and 5) at the Crystal River North station were completed. This report focuses mainly on decisions affecting continued operations of Crystal River Units 1 and 2, also referred to as CR South.

Environmental regulations governing operations of large utility coal generating units like Crystal River Units 1 and 2 have been evolving dynamically over the past couple of decades. In 2012, new environmental requirements were established for CR South by the Florida Department of Environmental Protection (FDEP) related to the Clean Air Visibility Rule (CAVR, a continuation of the 1999 Regional Haze policy), and from the US Environmental Protection Agency (EPA) which issued the final Mercury and Air Toxics (MATS) Rule. Based on these new regulatory requirements, the Company reassessed its compliance strategy for the units at CR South.

In April 2013, in the "Review of Integrated Clean Air Compliance Plan" filed with the Florida Public Service Commission (FPSC), the Company advised that installation of new selective catalytic reduction (SCR) and flue gas desulfurization (FGD) emission control systems at CR South for long term continued operation would not be economically feasible and that it would no longer be considering that alternative. This addendum to the environmental compliance study presents the Company's findings and recommendations addressing compliance alternatives in the shorter term, and their relationship with the plan for replacement power and maintaining system reliability. Once the bulk of the engineering, planning and compliance investigations had been completed, the working group defined two alternatives for evaluation, which can be summarized as follows:

Alternative 1: *Retire the CR South units in April 2016 in response to the MATS compliance dates and meet system requirements with purchased power and/or new resources in a manner that the grid would support.*

Alternative 2: *Establish a MATS compliance plan for CR South and configure the units to operate in compliance through mid-2018, and establish a resource plan to provide for replacement combined cycle generation in that timeframe. This alternative includes a competitive solicitation for combined cycle energy and capacity starting in 2018, identification of additional resources needed in 2016 and beyond, and a transmission plan that supports the required resources.*

The working group established and compared the quantitative and qualitative merits of pursuing either of these alternatives. In the results of the quantitative economic analysis, the projected lifecycle costs for continued operation of the CR South units through mid-2018

(Alternate 2) was \$ 307M lower than the projected costs for retiring the units in mid-2016 (Alternate 1). In the qualitative planning assessment, the team noted that the limited continued operations alternative has a significant positive impact on system reliability if operations of the CR South units are continued until replacement generation can be added near Crystal River, or until transmission projects can be completed to address grid concerns. One of the challenges associated with limited continued operations will be cost effectively maintaining plant reliability with these older units under the requirements imposed under these new regulations.

Recommendations and Management Actions

The results of the quantitative and qualitative planning evaluations illustrate that there are significant economic and reliability benefits for DEF and its customers associated with selecting the alternative to continue operating CR South for a limited period of time. Based on these findings, the working group presented the results of the evaluations and a recommendation to the management teams in July and August. Management accepted the recommendation to continue moving forward with the plan to pursue limited continued operation of CR South, and concurred with the plan to continue testing the alternate coals, make the necessary plant configuration changes and pursue the permitting actions required. The working group will continue moving forward with the implementations of the recommended alternative.

1 Introduction

THE CRYSTAL RIVER SITE

DEF owns and operates the Crystal River Energy Complex, which is a large power generation complex in coastal west central Florida, which includes four coal-fired units and a recently retired nuclear generating unit. Commercial operations at the Energy Complex began in 1966 with Unit 1, the first coal fired steam unit at the site. Commercial generation at the site continued to expand over the years with the addition of another coal fired steam unit in 1969 (Unit 2) to complete the CR South station, and a B&W PWR nuclear unit (Unit 3, or CR 3) in 1977. As each new unit was added, the site transmission, cooling water and other common infrastructure systems were expanded to accommodate the new additions. A decade later, the company added two additional coal fired steam units (Units 4 and 5) at the Crystal River North (CR North) station to complete the generation expansion at the site. At that time, the 230 kV and 500 kV transmission system expansions were completed to support development of CR North and to meet the grid stability requirements for CR 3.

Crystal River Units 1 (CR 1) and 2 (CR 2) at the CR South station fire pulverized coal in Combustion Engineering controlled circulation, tangentially-fired, drum-type, balanced draft, dry bottom boilers to generate superheated steam at 2,520 psig and 1,000 F. The steam output of the boilers drive tandem compound, reheat, condensing steam turbine-generators which are currently rated to produce 370 MW and 499 MW net, respectively, in the summer months. The units have both been fitted with low NO_x burners and close-coupled over-fire air systems to decrease nitrogen oxide emissions and operate with electrostatic precipitators (ESP's) to reduce particulate emissions. The four coal units at the site share common fuel handling systems that receive fuel by barge and rail and distribute fuel to the South and North coal yards where it is stacked and reclaimed for use in the plants. At the present time, CR South is utilizing Central Appalachian (CAPP) bituminous coal received by rail, and CR North is utilizing Illinois Basin (ILB) bituminous coal received by barge.



Figure 1-1 Crystal River Energy Complex

PURPOSE OF THE STUDY

On April 2, 2013, the Company filed the “*Review of Integrated Clean Air Compliance Plan*” with the Florida Public Service Commission (FPSC) which provided a compliance planning update including new information related to the compliance alternatives under considerations for the CR South units. In that document, the Company advised that installation of new selective catalytic reduction (SCR) and flue gas desulfurization (FGD) emission control systems at CR South for long term continued operation would not be economically feasible, and that it would no longer be considering that alternative. The Company also advised that it would continue to evaluate an alternative to retire the units in mid-2016 in response to MATS, and an alternative to continue operation of the units for limited period in compliance with MATS. The purpose of this addendum (to the original compliance analysis study for CR South¹) is to document the analysis, conclusions and recommendations reached in that assessment of the remaining alternatives.

¹ Progress (Duke) Energy Florida: *Crystal River South (Units 1 and 2) Environmental Compliance Study*; Internal Study Prepared By Central Engineering & Services (Strategic Engineering); October 2012 [Rev1 April 2013]

2 Environmental Compliance Requirements

The assessments that have been performed in support of the CR South compliance plan are based on the best information available regarding compliance requirements established in current regulations. If environmental compliance requirements change as a result of policy changes or court challenges, these plans may be reviewed and updated, as deemed appropriate.

NEW AIR COMPLIANCE REQUIREMENTS

Key compliance requirements for “limited continued” operation of CR South are outlined in this section, referenced to key provisions of the existing and new regulations.

Clean Air Visibility Rule/Regional Haze

In June 2005 the EPA finalized the Clean Air Visibility Rule (CAVR), which is an amendment to the Regional Haze Rule of 1999. The CR South units are required to meet the Best Available Retrofit Technology (BART) provisions of this rule, and in January 2009, the FDEP issued DEF a permit modification for CR South which established new emissions limits for visibility with particulate, effective January 2014.

In addition, in September 2013, the EPA approved Florida’s State Implementation Plan (SIP) to address Reasonable Further Progress (“Beyond BART”) requirements which are scheduled to take effect in 2018. The CR South permits included in the SIP revisions were structured to include options for DEF to add scrubbers and selective catalytic reduction systems (SCR’s) in 2018 or cease burning coal in Units 1 and 2 on or before the end of 2020. (The Company has subsequently chosen the latter option.) The EPA’s decision approving the SIP has been challenged in the courts by environmental groups, but the provisions of the SIP are expected to take effect, pending the outcome of litigation. Table 2-1 summarizes the CR South emissions limits per the current permit provisions of the rule.

Table 2-1. BART Emission Limits

			CR1 Limits	CR2 Limits
Current	PM	lb/MMBtu	0.1	0.1
	Opacity	%	40%	20%
2014 BART	PM	lb/MMBtu	0.04 Combined (<i>Steady State Wt Avg Heat Input</i>)	
	Opacity	%	30%	15%
2020	SO ₂ /NO _x		Cease Coal Firing Operations by end of 2020	

Mercury and Air Toxics Standards (MATS)

The US EPA issued the Mercury and Air Toxics Standards (MATS) rule in February 2012. The MATS rule establishes new standards for emissions of various metals and acid gases from both coal and oil-fired electric generating units (EGU's) and applies to all existing coal and oil-fired EGUs, including CR North and CR South. Compliance generally must be achieved within three years of EPA's adoption of new standards (i.e., April 2015), although the MATS Rule authorizes permitting authorities (Florida Department of Environmental Protection, or FDEP) to grant one-year compliance extensions in certain circumstances. Table 2-2 shows the MATS limits for each of these constituents which will be applied.

Table 2-2. MATS – Key Hazardous Air Pollutants Limits

			MATS Limit	Averaging Period
Hg	MATS Limit	lb/TBtu	1.2	30 day
	Alternate MATS Limit	lb/TBtu	1.0	90 day
Filterable PM	MATS Limit	lb/MMBtu	0.030	30 day
HCl	MATS Limit	lb/MMBtu	0.002	30 day

For long term operations of CR North, it is anticipated that the new emission control systems originally installed for compliance with the Clean Air Interstate Rule (CAIR) will be sufficient to reliably meet the MATS limits. For the limited period during which all four units at the site are expected to be operating under MATS, DEF plans to apply the site wide averaging provisions of the MATS rule which allow for averaging of selected regulated emissions across co-located units at a plant site like Crystal River.

The Company expects to submit a request to the FDEP for a one year extension of the MATS compliance date for the CR South units from April 2015 to April 2016, in accordance with the provisions included in the new MATS Rule.

CR SOUTH COMPLIANCE ANALYSIS

In order to maintain reliable unit operations during this limited transition period, a key objective was to identify and develop compliance options that did not require extensive, costly modifications to the CR South units, since the option for installation of scrubbers and SCR's had already been eliminated in prior review. For the limited period during which the MATS site wide averaging provisions would be employed, DEF focused on HCl emissions for acid gasses, along with mercury and PM emissions to assess and determine expected performance requirements for the site. The focus of the compliance analysis was to identify low constituent fuels that would help reduce emissions, coupled with consideration for targeted projects that would offer a cost effective approach to ensure compliant operations and system reliability. The compliance analysis was performed by Strategic Engineering, Environmental Services and

Integrated Resource Planning with guidance and support from, Transmission Planning, Energy Control and the staff at the plant.

Fuels

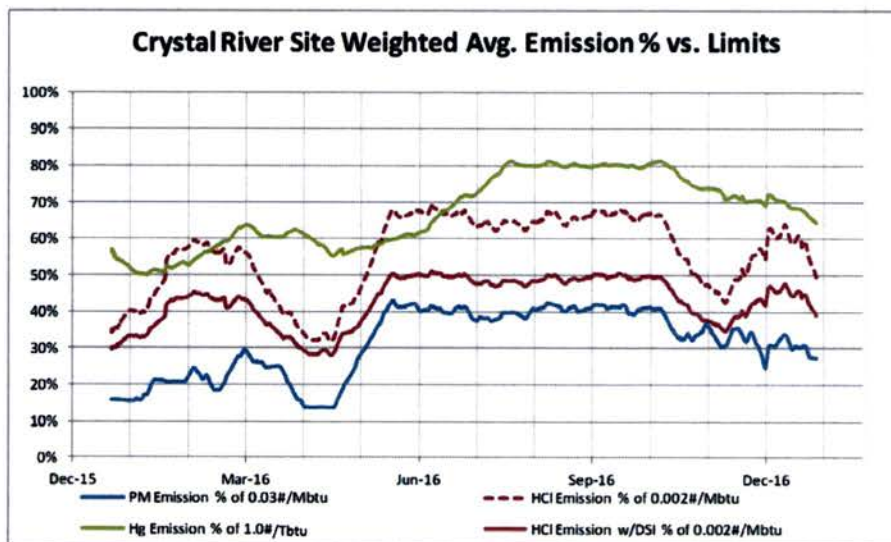
Initially, DEF determined that continued operation of the CR South units on the Central Appalachian (CAPP) coal currently used would result in emission levels of HCl and mercury that would exceed the new MATS limits. Since the CR South units are permitted for bituminous coals, the Company identified several western bituminous coals with lower levels of mercury and chlorides that would support compliant operations and provide reduced emissions during the MATS operating period.

Compliance Analyses

The compliance analyses addressed plant systems performance, plant output and projected emissions with the alternate coals under consideration. The engineering team performed plant performance analysis using the VISTA™ combustion systems model to predict thermal performance of the boilers and emissions performance of the boilers and precipitators. The thermal and emissions performance analysis helped the engineering team estimate the extent that unit output might be curtailed to economically maintain compliance performance levels for the units. A 15% reduction in the peak output of the units was chosen as a representative assumption for planning purposes, which resulted in a reduction in summer net capacity from 869 MW to 740 MW.

Using the projected performance information provided by the engineering team, the planning team performed system operations analysis utilizing EPM/PROSYM™ to predict system dispatch and projected plant operating requirements over the forecast period of interest with different fuel options. These results provided the engineering team with information needed to develop a predictive model to project Crystal River site emissions averaging performance with the alternate fuels and reagent injection systems. The modeling provided projected unit operations and performance based on economic fleet dispatch, projected outages, and other factors to support the projections for 30 day and/or 90 day emission averages for the MATS constituents. This predictive modeling also allowed the engineering team to estimate HCl emission reduction potential using hydrated lime reagent injection, mercury emission reduction potential using activated carbon injection and the particulate performance requirements during the period. Figure 2.1 depicts a typical one year emission projection cycle based on the analytical methods described.

Figure 2-1. Predicted Site Average MATS Compliance (Baseline, Typical)



In the assessments of emissions performance with western bituminous coal, the baseline projections reflect that the units would meet the site average MATS performance requirements during the limited continued operating period for CR South after MATS takes effect. Sensitivity studies were also performed to assess impacts that might be expected with different combinations of units on-line and off-line. During periods when one or both of the scrubbed units at CR North were projected to be off-line, the reduced emissions resulting from utilization of the proposed reagent systems at CR South will extend the site average compliance timelines to support system reliability.

From these assessments, it was determined that installation of the reagent systems is required to support a reliable compliance plan, and that compliance appears achievable with the targeted western bituminous fuels. Based on the results of these studies, the Company elected to pursue development of a plan to achieve compliance for the limited continued operating period, including identification of projects and upgrades required to achieve these results and establishment of a test program to evaluate performance with the alternate fuels and reagents.

3 Planning Analysis

This section provides an overview of the planning alternatives considered and the studies performed to evaluate the alternatives for CR South operations and compliance.

ALTERNATIVES CONSIDERED

In the April 2013 compliance study², the Company reviewed alternatives including a long term compliance plan, involving addition of substantial new emission controls systems, compared with alternatives to shut the units down and replace the generation resources. The alternatives for replacement of the generation at CR South were found to be more economic than the long term compliance alternative. Natural gas fired combined cycle generation was identified as the preferred economic replacement generation for the units at Crystal River. DEF's planning, development and engineering teams reviewed options for replacement power and system infrastructure requirements to address the timelines for retirement of the CR South units.

Assessment of Replacement Power Options: The generation resource plan in the 2013 DEF Ten Year Site Plan (2013 TYSP) recognized that CR3 would not return to service, anticipated retirement of the CR South units in April 2016, identified a new combined cycle unit in 2018 as the next planned generating unit and discussed the ongoing review of power purchases and other options beginning in 2016 to meet DEF's resource needs. The 2013 TYSP mentioned that DEF would also review alternatives to allow the CR South units to continue operating for a limited period of time in compliance with the MATS requirements

Assessment of Transmission Grid Requirements: The planning teams considered several approaches to address concerns identified in the system thermal and stability studies performed for these plant shut down scenarios. The teams focused on the specific grid operating conditions and the alternatives for replacement power in the short term and the longer term. From those evaluations, it was determined that the large generation deficits resulting from removal of the three units at Crystal River, coupled with replacement power flowing from central Florida would result in significant changes in system power flows. These changes were projected to exacerbate a number of localized system constraints and cause overloads elsewhere on the system that would need to be addressed. The DEF Resource Planning and Transmission Planning teams worked together to assess the transmission resources required to support the replacement power

² Progress (Duke) Energy Florida: *Crystal River South (Units 1 and 2) Environmental Compliance Study*; Internal Study Prepared By Central Engineering & Services (Strategic Engineering); October 2012 [Rev1 April 2013]

alternatives under consideration, and to characterize the transmission system benefits that would be attainable if the Company were to pursue limited continued operation of the CR South units.

Based on the information available, and the resource options being considered, the Company's planning teams determined that DEF transmission system projects valued at an estimated \$150M could be deferred if the CR South units were to remain in service during the interim period, and eliminated if replacement generation were constructed at or near the Crystal River site. At the Company's request, the Florida Reliability Coordinating Council (FRCC) also performed a transmission study of these conditions in June 2013 in the course of their reliability planning assessment cycle.

The FRCC's study confirmed the transmission reliability concerns associated with retirement of the CR South units in 2016 and identified significant transmission system upgrades that would be required for DEF and adjacent systems. While the issues identified may be addressed with transmission system upgrades, the timing and cost of the required upgrades present challenges and risks.

These resource options and power flow studies helped refine the information required to characterize the alternatives evaluated in the Company's economic planning assessment. The alternatives considered were:

Alternative 1: *Retire the CR South units in April 2016 in response to the MATS compliance dates and meet system requirements with purchased power and/or new resources in a manner that the grid would support.*

Alternative 2: *Establish a MATS compliance plan for CR South and configure the units to operate in compliance through mid-2018, and establish a resource plan to provide for replacement combined cycle generation in that timeframe. This alternative includes a competitive solicitation for combined cycle energy and capacity starting in 2018, identification of additional resources needed in 2016 and beyond, and a transmission plan that supports the required resources.*

ECONOMIC ANALYSIS

In summary, the analyses performed compared the economics of a scenario in which CR South continues to operate through mid-2016, versus a scenario where the CR South units are operated through mid-2018 when the next planned combined cycle unit is available. The Company's Integrated Resource Planning Team performs these economic studies of alternatives using simulation models that develop and compare system operations and investments costs between various alternatives and characterize the results in terms of the present value of annual and cumulative revenue requirements (PVRR and CPVRR). The analysis of revenue requirements provides an economic perspective of costs from the customers' viewpoint which is a fundamental tenant in regulatory reviews of alternatives.

The study results were generated using the Strategist[®] model to provide differential CPVRR results between the primary alternatives, using planning forecasts and standard key assumptions current at that time. The base (reference) case was evaluated using the corporate mid-range fuel price forecasts, corporate forecasts for the cost of capital, projections for emission allowances and a proxy forecast for potential CO₂ allowance costs.

Summary of Key Planning and Analysis Assumptions

The analyses and studies performed supporting the recommendations in this report were finalized in July 2013. Brief summaries and explanations of several of these key assumptions are provided here for reference:

- The alternative to retire CR South in mid-2016 included consideration for purchased replacement power from existing IPP and utility sources. A portfolio of source options was developed through a solicitation for short term power. As noted, this alternative included required transmission projects that would need to be completed between 2014 and 2017 at an estimated cost of \$150 million. The costs for the transmission system infrastructure changes and uplift projects were based on preliminary estimates provided by Transmission Planning.
- The alternative to extend CR South operations through mid-2018 included costs for continued operation and maintenance of the units, permitting and plant configuration to accommodate the MATS compliant fuels, and the costs for the alternate fuels and reagents. The estimates for limited continued operating and maintenance costs were based on ongoing costs of operation and were provided by plant staff with input from the engineering and planning teams. The additional costs estimated for the plant configurations required for MATS were in the \$20 - \$30 million range and were provided by the Company's engineering and environmental teams, with support from subject matter experts on the emission control systems. The forecasts for alternate coals and reagents were provided by the Company's fuel and reagents procurement teams.
- The alternative to continue CR South operations through mid-2018 also included assumptions for generation performance levels and emissions during the MATS compliance period. Since the alternate fuels principally being considered are bituminous coals, there were no material changes assumed in plant efficiency. However, given the lower levels of sulfur in the alternate fuels, and the expected effects of hydrated lime injection, the nominal full output of the units was reduced by 15% to conservatively reflect potential performance limits in the electrostatic precipitators. Under current conditions, the units are nominally rated at 869 MW. During the MATS compliance period, the maximum output of the units was assumed to be 740 MW. A portion of the configuration costs assumed for this alternative are attributable to projects required to ensure proper precipitator performance levels with the alternate coals and reagents.

- Costs for replacement power were represented by the indicative prices received in the solicitation for power purchases. Reserve margins were maintained at or above 20% in a manner consistent with PEF's planning reliability criteria.

Economic Analysis – Results

The results of the quantitative analysis presented in this section reflect the relative cost differences between the two compliance alternatives. The comparisons are expressed as a difference in the Cumulative Present Value of Revenue Requirements (CPVRR) values calculated (in \$2013) for each alternative scenario over the planning period in the study.

In the analysis, the projected system cost (CPVRR) for the option for continued operation of the CR South units through mid-2018 (Alternate 2) was \$ 307M lower overall than the system CPVRR for the option of retiring the units in mid-2016 (Alternate 1), i.e. a projected savings of \$307 million in \$2013. Table 3.1 below provides a summary of the differences in CPVRR between these alternatives, listed by segments of cost.

Table 3.1 Base Case Results - CPVRR Differential Values for Key Segments of Cost

CR South Continued to 2018 versus CR South Retired in 2016 (Net Differences: Alternative 1 versus Alternative 2)	Differential CPVRR (\$M)
<i>Net Differences in Revenue Requirements to Cover Capital</i>	\$ 100
<ul style="list-style-type: none"> • CR South Compliance Projects • System Transmission Upgrades 	
Fuel and Other Variable Production Costs	(\$ 56)
Costs for PPA Replacement Energy & Capacity	\$ 288
Other Costs	(\$ 25)
Resulting Net Benefit of CR South Limited Continued Operations	\$ 307

Note: Differential CPVRR values \$Million in \$2013

QUALITATIVE CONSIDERATIONS

In addition to the quantitative review, there are also important factors in the evaluation process that are more difficult to quantify and can be addressed at a qualitative level in the review. Some of the stronger factors weighing in both directions are summarized below. In addition, Table 3.2 provides a summary overview of qualitative areas that were considered in the development of recommendations amongst alternatives for limited continued operation of the CR South units.

Factors Weighing Toward Limited Continued Operations: Transmission system reliability and operational flexibility would be weighted as the most positive considerations for the limited continued operations option. Retirement of the CR South units and the uncertainties surrounding the ability of DEF and adjacent systems to implement the resulting required

transmission projects by 2016 introduce significant reliability concerns. The option to continue operations of CR South until replacement generation can be added near Crystal River, or until transmission projects are implemented to address these grid concerns, helps significantly reduce reliability risk. Also, the air permits for CR South allow the units to continue operating on coal through 2020, presuming compliance with all applicable regulations, which offers some additional flexibility, if needed.

Factors Weighing Against Limited Continued Operations: Challenges with continued operations were weighted as the most significant considerations against the limited continued operations option. The units at CR South are over 45 years old and are at the larger, more complex end of the spectrum for coal units that are being considered for retirement. The Company’s plan to limit continued operations in this mode to just two to three years will help limit this risk.

Table 3.2. Qualitative Comparison of Alternatives

Qualitative Comparison of Alternatives for Crystal River South CR South Continued to 2018 versus CR South Retired in 2016			
	Level	Retire 2016	Retire 2018
Transmission system reliability	H	○	●
Operational flexibility	M	○	●
Operations and compliance challenges	H	●	○
Most Favorable ● Least Favorable ○			

IMPRESSIONS FROM THE PLANNING ANALYSIS

The results of the Company’s quantitative and qualitative evaluations of these CR South compliance alternatives were reviewed with the management teams in Power Generation Operations and the Florida region as the plans evolved. These key stakeholders supported the recommendation to continue forward with finalizing the plant configuration changes needed to comply with the new environmental regulations and continue plant operations, presumably into 2018. The results of the continued investigations and subsequent evaluations summarized in this report support recommendations presented to management in July and August. The quantitative economic analysis of compliance alternatives supports the recommendation to pursue limited continued operation of CR South. The qualitative considerations also support this recommendation.

4 CR South Alternate Fuel Testing

DEF conducted a two phase alternate fuels testing program to evaluate plant systems and emissions performance while burning low mercury and chlorine western bituminous coals and injecting different reagents (sorbents for emission reduction). In the first phase, DEF evaluated the handling and combustion of western bituminous coal and collected baseline emissions data.

Phase 1 Testing

One of the western bituminous coals identified in the screening evaluations was selected for the initial trials in June 2013. The bituminous coal from Arch Coal's West Elk mine in Colorado was purchased and shipped to the Crystal River site in June for testing. Some mill and primary air flow adjustments were made to accommodate the fuel change. Since the fuel had much lower levels of sulfur than the CAPP coal normally used, the PM and opacity levels rose, as anticipated, in response to the increase in ash resistivity. There were some minor adjustments made on the ESP power settings and rapping programs to compensate, within the existing capability of the equipment. Once the trials were completed, the units returned to use of the normal CAPP coals.

The results of the first phase of the trials established that the plant would be able to handle and fire the western fuel without incident and that the emissions performance was in line with expectations and consistent with the levels needed to support the MATS plan under development. These results supported continuation with the second phase of the trials which involved more detailed characterization of emission performance at different load levels and testing utilizing hydrated lime and activated carbon injection.

Phase 2 Testing

Test permits were obtained to allow the use of these reagents and the second phase of testing was scheduled in October and November 2013. For consistency and comparison with the first phase results, the West Elk coal was utilized for the second phase as well. The Phase 2 trials were performed and the required emissions data was gathered to allow the engineering team and the emission controls specialists to assess equipment performance levels and identify the changes that would be needed to accommodate operations at lower emission levels. The team also performed some additional tuning and ESP adjustments to assess performance levels with the current plant configuration.

Impressions from Alternate Fuel Testing

The main objectives of the testing program were to establish the ability of the units to successfully fire the alternate coals and to gauge emissions performance levels with alternate coal and reagents.

Operations: During the trials, the operations and test support team monitored fuel handling systems, bunkering and coal mill systems, boiler air and flue gas systems, soot blowing systems and precipitator performance. Operation of the fuel handling and boiler systems was nominal and no excessive slagging or fouling was observed in the boilers during the tests. Close attention was paid to the soot blowers to determine if boiler cleanliness could be maintained with the existing systems. The biggest challenge encountered was precipitator performance, which was anticipated with the lower sulfur coals and reagents. The ash levels in the precipitators tended to build up over time and opacity had a tendency to creep up during the full load runs during the day. During off-peak periods when unit output was reduced, the precipitators were able to clear some of the accumulated ash and improve performance.

The company's operations team and emission control experts performed precipitator inspections prior to the tests, closely monitored performance during the trials, made controls tuning adjustments to improve performance and made note of the adjustments and configuration changes needed to improve performance levels for compliance with the new reduced emissions limits. In summary, from an operations standpoint, the fuel handling and boiler systems performance were acceptable to support the limited continued operating period under MATS compliance. In terms of PM and opacity, the performance of the precipitators was challenged during the trials, as anticipated, and the engineering team provided appropriate recommendations for adjustments and configuration changes that will be implemented to ensure required levels of performance during the limited continued operating period (see Section 5 for more details).

Emissions Performance: In the compliance analysis performed prior to testing, DEF projected the levels of sulfur, ash, chlorine and mercury in the alternate coals as well as removal efficiencies anticipated for the hydrated lime and activated carbon to reduce HCl and mercury.

HCl, Mercury and Reagents: During the trials, hydrated lime and activated carbon injection reduced HCl and mercury, respectively, within the targeted range of emissions. During the tests with hydrated lime injection, the anticipated reductions in precipitator performance were also observed. During the tests with activated carbon injections, there were no detrimental precipitator performance effects noted, but higher levels of carbon in the flyash may have an impact on ash utilization and/or disposal. The engineering and environmental teams will use the information gathered to determine how the reagents may be employed.

Particulate Emissions: New performance levels for PM emissions and opacity are going into effect in 2014 under the BART permit provisions of the Regional Haze Rule, and additional PM limits will be imposed under MATS. In its compliance analysis, DEF determined that meeting the lower PM limits under BART at the desired plant output levels will also provide sufficient PM reductions to satisfy the MATS requirements. As expected, while the units can meet the BART PM limit using the normal CAPP coal, the units had difficulty meeting the PM limits with the alternate coal and reagents during the trials. The compliance planning team anticipated these challenges in the original

projections for precipitator performance and plant output limits, and has used the data to determine what ESP changes are needed to meet the compliance targets. Once the recommended precipitator changes are completed, the PM performance should be sufficient to meet both the BART and MATS requirements while using the alternate coals and reagents. Additional testing will be required to confirm that compliance levels are being achieved.

The results from the alternate coal trials generally confirm the predictions developed during the compliance analysis and support the areas of focus that need to be addressed to prepare the units for MATS compliance. The findings in the first two phases of the alternate coal trials support the expectation that the units will be capable of performing as needed during the limited continued operating period, once the required changes have been implemented.

5 CR South Compliance Projects

The compliance analyses, performance testing and emissions test results provided the information required to develop the plan for configuration changes required to address compliance requirements for the limited continued operating period. This section provides an overview of the CR South compliance projects currently being developed and implemented. The current estimated cost of these compliance projects is in the \$25 - \$30 million range which is consistent with the range estimated for planning.

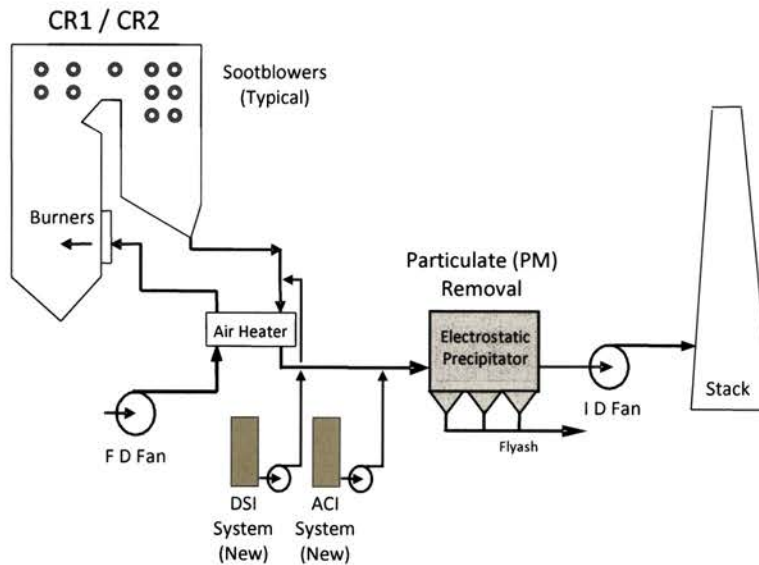
As with any plan related to existing facilities, the scope, timing and selection of projects may need to be adjusted as the work is undertaken. This overview is based on current expectations, and the plan is reasonable based on all of the information known at this time. The performance improvement results from the precipitator projects will also help determine the output capability limits for the units. The output levels assumed in the engineering studies still appear reasonable, but the final results will depend on many unit-specific factors, and output levels may be more or less than the predicted values.

COMPLIANCE PROJECTS

Reagent Systems: The addition of dry sorbent injection (DSI) systems utilizing hydrated lime is needed to reduce HCl emissions. Since chlorine levels in the targeted fuels are low, the DSI system would be relatively small and require low injection rates to achieve the results desired. The addition of activated carbon injection (ACI) systems is also needed to reduce mercury emission levels. Like the DSI systems, the proposed ACI systems would also be relatively small to meet the reduction levels envisioned, and both systems would be set up to operate intermittently or continuously, depending on the needs of the facility. The reagents would be injected upstream of the precipitators, as depicted in Figure 5-1, and the resulting reactants would be captured in the precipitators.

Electrostatic Precipitators (ESP's): As detailed in Section 2, the PM and opacity compliance limits under BART and MATS are lower than past operating limits. The PM performance results gathered during testing confirm that precipitator performance needs to improve and that the specified projects are required to reduce PM emissions to meet compliance requirements at the desired output levels. The list of required ESP projects is included for review in Appendix B. The engineering and project teams will establish the timing and sequencing of these projects to provide time for installation, testing and adjustments needed to support the compliance timelines.

Figure 5-1. Proposed Boiler and Emission Control Systems Configuration



Plant Systems: Additional plant systems projects have been incorporated in the compliance plan to ensure that performance of the fuel handling systems, boiler systems, related combustion systems and plant controls support the operating configurations required for compliance. The projected costs for the planned projects is included below in Table 5.1, and a current list of these planned projects is included in Appendix B. The project planning process and additional performance analysis and testing may also reveal additional projects or adjustments to the current planned projects that are required to ensure compliance.

Table 5-1. CR South Compliance Projects Summary

CR South Compliance Projects Summary

- Reagent Systems
- ESP Projects
- Plant Systems Compliance Projects
- CR South Testing and Regulatory Support

Total

Total Project Costs (\$ Million)	
\$	REDACTED
\$	REDACTED
\$	REDACTED
\$	REDACTED
\$	28.0

REDACTED

PROJECT TIMELINES

Implementation schedules are being developed for each of the projects, based on planned unit outages and material procurement. The implementation schedules will also accommodate additional operational testing and system tuning to ensure that plant performance meets the new compliance limits.

6 Conclusions and Recommendations

The Company's Strategic Engineering Team, in close collaboration with Integrated Resource Planning and Analysis, Environmental Services, Plant Operations, Fuels and the Florida Regional Team, have been addressing the latest environmental regulations and emerging policy requirements that require that changes be made to achieve compliance at the CR South facility, or would require the Company to retire the facility.

This addendum to the CR South Environmental Compliance Study presents the working group's findings and recommendations addressing compliance alternatives in the shorter term and their relationship with the plan for replacement power and maintaining system reliability. Once the bulk of the engineering, planning and compliance investigations had been completed, the working group defined two alternatives for evaluation, which are described in some detail in this report, and can be summarized as follows:

Alternative 1: *Retire the CR South units in April 2016 in response to the MATS compliance dates and meet system requirements with purchased power and/or new resources in a manner that the grid would support.*

Alternative 2: *Establish a MATS compliance plan for CR South and configure the units to operate in compliance through mid-2018, and establish a resource plan to provide for replacement combined cycle generation in that timeframe. This alternative includes a competitive solicitation for combined cycle energy and capacity starting in 2018, identification of additional resources needed in 2016 and beyond, and a transmission plan that supports the required resources.*

The working group performed a quantitative and qualitative analysis of the two alternatives, and both assessments favored Alternative 2. The results of the quantitative and qualitative planning evaluations illustrate that there are significant economic and reliability benefits for DEF and its customers associated with selecting the alternative to continue operating CR South for a limited period of time. The working group presented the results of this assessment, and the Company's management accepted the working group's recommendation to continue moving forward with implementation of this alternative. The working group will continue moving forward with implementation.

A References

1. Progress (Duke) Energy Florida: *Crystal River South (Units 1 and 2) Environmental Compliance Study*; Internal Study Prepared By Central Engineering & Services (Strategic Engineering); October 2012 [Rev1 April 2013]
2. Progress Energy Florida: *Review of Integrated Clean Air Compliance Plan*; Submitted to the Florida Public Service Commission; April 2, 2013
3. PEF Permit No. 0170004-035-AV, Crystal River Power Plant Title V Air Operation Permit Revision, effective June 13, 2012.
4. PEF Docket No. 060007-EI, *Progress Energy Florida – Integrated Clean Air Compliance Plan*, submitted to the Florida Public Service Commission, dated March 31, 2006.
5. PEF Permit No. 0170004-017-AC, *BART Project*, effective February 26, 2009. (BART Implementation Plan for PM)
6. PEF Permit No. 0170004-036-AC, *Sulfur Dioxide Emissions Standards/Controls*, effective September 6, 2012. (BART Implementation Plan for SO₂)
7. PEF Permit No. 0170004-038-AC, *Nitrogen Oxides Emissions Standards/Controls*, effective October 10, 2012. (BART Implementation Plan for NO_x)

B CR South Compliance Projects Summary

The following list summarizes the CR South compliance projects and preliminary cost estimates for the limited continued period of operations. The specific projects and cost estimates have been updated since the original planning analysis was performed, so there are some differences, but the overall project costs and performance estimates are similar and are still reasonable for planning purposes. Project cost estimates will be updated as the projects develop and are subject to change as scope and timing are refined.

		Total Project Costs (\$ Million)
Reagent Systems		
Dry Sorbent Injection (DSI) Systems Projects		
Activated Carbon Injection (ACI) Systems Projects		
ESP Projects		
Flue Gas Redistribution		
High Frequency Power Supplies		
Hopper High Level Indicators & Hopper Vibrators		
High Voltage Rapper Connections Project		
Rapper Testing, Adjustments and Optimization		
Additional Flow Baffles		
Recommission Last 3 Fields of CR2 Old A/B ESP		
Precipitator Ash Conditioning (Secondary)		
Plant Systems Compliance Projects		
CO Monitors		
Economizer Soot Cleaning (Secondary)		
Combustion Optimization Project		
ID Fan Flue Gas Flow Bias Project		
Plant Controls for ESP Data Acquisition		
Appendix K Sorbent Trap Systems		
PM CEMS for Particulate Monitoring		
Unspecified Plant Projects		
Fuel & Ash Handling Systems		
CR South Testing and Regulatory Support		
MATS Related Plant Testing (ECRC)		
MATS Compliance Procedure & CEMS Software		
MATS Work Practice Standards		

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CR South Compliance Projects Summary

Reagent Systems
 ESP Projects
 Plant Systems Compliance Projects
 CR South Testing and Regulatory Support

		Total Project Costs (\$ Million)
	\$	
	\$	
	\$	
	\$	
Total	\$	28.0



Robby A. Odom
Station Manager,
Crystal River Steam Plant & Fuel Operations

Submitted via email to:
Brian.Accardo@dep.state.fl.us

April 30, 2013

Brian J. Accardo, Director
Division of Air Resource Management
Florida Department of Environmental Protection
2600 Blair Stone Road, M.S. 5500
Tallahassee, Florida 32399-2400

RE: Air Permit No. 0170004-036-AC

Dear Mr. Accardo,

Air permit No. 0170004-036-AC for Duke Energy Florida's (DEF or the Company) Crystal River Plant obligates DEF to make a binding decision by January 1, 2015 to either discontinue the operation of Units 1 and 2 as coal-fired units by December 31, 2020 (Scenario A) or continue operation of these units subject to the requirements of the permit (Scenario B). DEF hereby notifies the Department of Environmental Protection (DEP) that the Company has decided to pursue Scenario A under Section 2, Paragraph 7 of the permit and cease burning coal in Units 1 and 2 by December 31, 2020. As set forth in Section 2, Paragraph 7, DEF's notification of its decision to pursue Scenario A renders the Scenario B option and its corresponding permit conditions obsolete.

Please contact me at 352-501-5682 if you have questions or need additional information. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read 'R. Odom'.

Robby Odom
Station Manager
Crystal River Steam Plant & Fuel Operations
Authorized Representative