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BUREAU OF AIR REGULATION

GULF POWER
A SOUTHERN COMPANY

Certified Mail
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January 26, 2010

Ms. Christy DeVore, P.E.
Florida Department of Environmental Protection
Division of Air Resources Management
2600 Blair Stone Road
Mail Station #5505
Tallahassee, Florida 32399-2400

Dear Ms.DeVore:

RE: CRIST ELECTRIC GENERATING PLANT
REQUEST FOR ADDITIONAL INFORMATION RESPONSE
AIR APPLICATION NO: 0330045-029-AC

On January 12, 2009, Gulf Power received a Request for Additional Information (RAI) for the Crist Air Construction Application 0330045-029-AC filed on December 14, 2009. The FDEP inquiry concerns several questions regarding the Crist Higher Sulfur Fuel Blend and the Crist Unit 6 Turbine Upgrade projects. In this regard, please find enclosed Gulf Power's response and applicable certifications for the Owner/Authorized Representative and Professional Engineer for this submittal.

In addition to the RAI, Gulf Power has received an update of the Crist 6 FCYCLE Model Results outlined in the Crist 6 Turbine Upgrade Description Document. Gulf Power hereby, revises the original description with information in Attachment 4 of this submission. The new model run reflects a new efficiency rating and slightly changed the emissions estimates for the turbine project from our previous submission. All other information remains the same as previously submitted for the Crist 6 Turbine Upgrade.

Please call me at (850) 444 – 6527 regarding any questions regarding this RAI response.

Sincerely,

Dwain Waters, Q.E.P.

G. Dwain Waters, Q.E.P.
Special Projects and Environmental Assets Coordinator

cc: w/att: Greg Terry, Gulf Power
John Dominey, Gulf Power
Trina Vielhauer, FDEP – Tallahassee Office
Rick Bradburn, FDEP Northwest District

Gulf Power Response to FDEP RAI Questions dated January 12, 2010
Crist Electric Generating Facility
Air Construction Application No: 0330045-029-AC
January 26, 2010

FDEP Question #1: For the steam turbine upgrade, please submit a table showing baseline actual emissions, projected actual emissions, change in emissions and Prevention of Significant Deterioration (PSD) significant emission rates.

Gulf Power Response:
A table with the requested information is located below: This table has been revised from previously submitted information with new information reflecting a slight higher efficiency increase due to the turbine upgrade. The changes were very minor.

Crist 6 Turbine Upgrade Emission Table

Pollutant	Baseline Emissions Tons/Yr	Future Projected With Fuel Change & Turbine Upgrade Tons/Yr	Emission Change Tons/Yr	PSD Significant Rate Tons/Yr
SO2	11,937.3	4788.0	-7149.3	40
NOx	2875.9	1437.9	-1438.0	40
SAM	38.8	61.0	22.2	7
SAM Cr 4-7 Cap	169.0	167.6	-1.4	7
PM	116.3	49.4	-66.9	25
CO	211	240	28.6	100
VOC	25.0	28.3	3.4	40

Notes:
1) SAM emissions will not result in a significant net increase under Gulf Power's SAM cap proposal for emissions offset
2) Does not exclude emissions associated with Demand Growth
3) Assumes high sulfur fuel blend and SCR control for future projected emissions

FDEP Question #2: Please provide an estimate of the cost to upgrade the Unit 6 steam turbine and the cost for the SAM mitigation system. Provide a description of the input parameters to the SAM mitigation system and how the lime injection rate will be controlled.

Gulf Power Response:
The cost of the upgrade of the Unit 6 steam turbine and the cost of the SAM mitigation system will be provided under a separate submission using "CONFIDENTIAL INFORMATION" protocols. This document will be hand delivered to FDEP from HOPPING, GREEN & SAMS, P.A.

A correlation between the hydrated lime injection rate and emissions will be utilized to develop a parametric model to reflect control of SAM emissions. The Crist Hydrated Lime Injection System was previously permitted as a temporary system under 0330045-026-AC. Condition 4c of this permit notes: "During each test run, the permittee shall monitor and record the following: the fuel sulfur content, coal firing rate for each unit, actual heat input rate for each unit, HLI rate and SO2 emissions rate for each unit as determined by existing continuous emissions monitoring systems (CEMS)". Gulf Power proposes to conduct performance tests as outlined in the previously issued permit to establish operating input parameters for SAM mitigation. Testing of the system is required within 90 days of startup.

FDEP Question #3: Please provide the equation used to calculate SAM emissions, a summary of the emissions test data supporting this equation and an example calculation.

Gulf Power Response:
The calculation used to estimate SAM emissions is an EPRI methodology used in the electric utility industry for many years. Gulf Power utilized this method in the Crist BART Analysis Report and in several air construction applications including the Crist Scrubber, Crist Temporary Use of Hydrated Lime, Crist Unit 7 Turbine Upgrade and annually in the Annual Operating Report and TRI Reports. A copy of the EPRI equations for the combustion, manufacture and release of sulfuric acid mist used in the BART Analysis are summarized in Attachment 1. A step by step calculation for Crist 6 sulfuric acid emissions projected in the Crist Fuel Blend and Crist 6 Turbine applications have been added on the final pages of this attachment. Gulf Power further demonstrated this methodology in testing Crist Units 4,5,6 and 7 in 2006 as part of the Crist Scrubber project. A summary of these results has been included as Attachment 2 of this submission.

FDEP Question #4: Please identify the catalyst conversion rate across the Unit 6 selective catalytic reduction (SCR) system. How does this compare with what is observed on the Unit 7 with SCR? Also, identify the individual baseline actual SAM emission rates for Units 4, 5 and 7. Which 2-year period was used to estimate the baseline actual SAM emissions for Units 4-7? Was the same 2-year period used for all other pollutants?

Gulf Power Response:
The catalyst conversion rate across a unit with a SCR is summarized for Crist Unit 7 in the BART Analysis paper in Attachment 1 discussed in item 3 above. The same conversion "Oxidation Rate" was assumed for the Unit 6 Turbine and Fuel Blend Projects. This calculation projects the pounds of acid mist manufactured by the SCR. The calculation is: $EM_{scr} = K * S2 * F_{sops} * E2$; where K is the molecular weight and units conversation factor = 3063; where S2 is the SCR catalyst SO2 Oxidation Rate (.0075 used for Crist 6); where F_{sop} is the operating factor for the SCR (assume 1.0 for full time operation of Crist 6 SCR); where E2 is SO2 produced as tons per year.

The projected Crist Unit 7 SAM emissions with SCR compares well with the actual acid mist test data taken in 2006. This data is summarized in Attachment 2. The summary compares use of the EPRI projected SAM formulas to actual stack test data. The EPRI calculation projects Acid Mist for Crist 7 on the day of testing at 0.0036 lb/mmbtu, 0.0034 lb/mmbtu using fuel analyses and CEMs data for SO2, respectively, to the "as SAM measured" rate at 0.004 lb/mmbtu. Gulf Power believes the EPRI projection calculation accurately represent SAM emissions for each unit with and without SCR at Plant Crist.

The 2-year period used to determine actual SAM baseline emissions at Plant Crist are based on the highest SO2 rate and heat input rate for each unit. These differ for each unit and are consistent with past FDEP instruction used in the FGD application to calculate baseline SAM emissions. The actual emissions are summarized in the submitted Crist 6 Turbine Upgrade and Crist Unit 6 High Fuel Blend applications in the CristEmissionsBaseline Excel worksheets under Baseline Summary. The same 2 –year period is not the same for all pollutants which is allowed by FDEP guidance. Additional consideration was given to choose a 2 – year period after installation of pollution control equipment. For example, the highest 2- year period for NOx was chosen after the installation of the SNCR or SCR control systems. As requested, the following table summarizes the 2 - year periods used to calculate Acid Mist Emissions.

Baseline Database	Crist 4	Crist 5	Crist 6	Crist 7
SO2 Rate (lb/mmbtu)	1.14	1.17	1.25	1.23
SO2 2Yr Dates	01/07 – 12/08	09/07 – 08/09	09/07 – 08/09	09/07 – 08/09
Heat Input (mmbtu/yr)	5137388	5319061	21145063	35469636
HI 2-yr Dates	06/06 – 05/08	01/07 – 12/08	06/06 – 05/08	11/05 – 10/07

FDEP Question #5: In the Tables "Emissions Impact Analysis Crist 6 Emissions Analysis with SCR with Max 2.4 SO2 lb/mmbtu fuel" and "Higher Sulfur Fuel Blend Scenario Crist 6 Emissions Analysis with SCR with max 3.40 SO2 lb/mmbtu fuel" the net change in NOx emission is (-1,484 tons/yr). In the table "Crist Emissions Analyses for High SO2 Fuel Blend @ 3.35 lb/mmbtu" the net change in NOx emissions is (-) 454.2 tons/year. Please explain the differences in these tables and provide additional calculations as necessary.

Gulf Power Response:

In regards to the first part of the question: There would be no difference in projected NOx emissions whether 2.4 SO2 lb/mmbtu or 3.40 lb/mmbtu fuel is used. (The referenced number 3.40 is a typo and should be 3.35 and all projected calculations are based on 3.35). The sulfur content of the fuel is not projected to change the NOx emissions in these cases. The only change in the fuel blend is the ratio of higher versus low sulfur coal in the fuel blending process before delivery to the plant. The sulfur content of the fuel is not projected to change the future NOx emission estimates.

The second part of the question requests an explanation of the difference between (-1,484) tons/yr and (-454.2) tons/yr in the applications. The difference is the delta between just Unit 6 NOx emissions from the baseline with future SCR (i.e. 1,484) and the delta from Crist Units 4-7 from the baseline, (i.e. -454.2). A copy of the summary calculations is included in this submission as Attachment 3.

FDEP Question #6: Please provide the SAM emissions in the following table:

Gulf Power Response:
A table with the requested information was submitted in the Air Construction Application No: 0330045-030-AC under the Cr Acid Mist tab in the Facility Attachment section as CristEmissionsBaseline(11)HSCoal120309.xls. The information is summarized below per requested, i.e., before and after control systems.

Projected Actual Emissions with HSC (3.35 lb SO2/Mmbtu)

Projected Actual SAM Emissions (TPY) *	Unit 4	Unit 5	Unit 6	Unit 7	Total
Before SCR Systems	18.73	18.20	111.34	179.30	327.57
After SCR Systems	18.73	18.20	207.74	334.51	579.18
After HLI System	6.89	6.71	75.54	122.38	211.51
After FGD System	5.41	5.27	59.04	95.91	165.62

Notes:
1) Does not exclude emissions associated with Demand Growth
2) Includes Bypass Operations
3) Emissions based on EPRI calculation for combustion, manufacture and release with projected control efficiencies for HLI and FGD.

Item 7: Gulf Power Additional Information: Gulf Power hereby revises information in the document "Crist 6 Project Description.doc" submitted on December 15, 2009 with Attachment 4. This document was revised due to new information regarding the efficiency rating of the Crist Unit 6 Turbine Upgrade. The new improved efficiency rating had a minor impact on projected emissions for project and is included in the emissions table in Item 1 above.

GULF POWER COMPANY
CRIST ELECTRIC GENERATING FACILITY
Air Construction Application 0330045-029-AC
Response to FDEP RAI letter 01/12/2010

Professional Engineer Certification

Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, the information presented in the Gulf Power Company submittal to the Department of Environmental Protection are true, accurate, and complete based on my review of material provided by Gulf Power engineering and environmental staff; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this submittal are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of air pollutants not regulated for an emissions unit, based solely upon the materials, information and calculations provided with this certification.

Greg N. Terry — *Signature* 1-26-2010 — *Date*

(seal)

*Certification is applicable to the Gulf Power Company submittal response to the Florida Department of Environmental Protection RAI dated 01/12/2010 regarding the Crist High Sulfur Fuel Blend and Crist 6 Turbine Upgrade Projects.

GULF POWER COMPANY
CRIST ELECTRIC GENERATING FACITLITY
Air Construction Application 0330045-029-AC
Response to FDEP RAI letter 01/12/2010

Owner/Authorized Representative Statement

Owner/Authorized Representative Statement:

I, the undersigned, am the owner or authorized representative of the facility addressed in this RAI response letter. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this submission are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this submission are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other requirements identified in the original application to which the facility is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit.*

James O. Vick (signature) — 1/26/2010
Signature *Date*

*Certification is applicable to the Gulf Power Company submittal response to the Florida Department of Environmental Protection RAI dated 01/12/2010 regarding the Crist High Sulfur Fuel Blend and Crist 6 Turbine Upgrade Projects.

Basis for Source-Specific Sulfuric Acid Emissions for BART Baseline Case

Basis for Source-Specific Sulfuric Acid Emissions for BART Baseline Case

Sulfuric Acid (H_2SO_4) Emissions

During the combustion of sulfur-containing fuels, a percentage of the SO_2 formed is further oxidized to SO_3. As the flue gas cools across the air heater, this SO_3combines with flue gas moisture to form vapor-phase and/or condensed sulfuric acid (H_2SO_4). The baseline H_2SO_4 emissions shown in Table 2-1 of this BART modeling protocol were calculated consistent with the method used by Southern Company to derive these emissions for Toxics Release Inventory (TRI) purposes. This method is documented in a report titled Estimating Total Sulfuric Acid Emissions from Stationary Power Plants: Revision 3 (2005) prepared by Keith Harrison and Dr. Larry Monroe (Southern Company Services) and Edward Cichanowicz (Consultant). The approach described in this report assumes that H_2SO_4 emissions released from the stack are proportional to SO_2 emissions from combustion and are dependent on the fuel type and the removal of H_2SO_4 by downstream equipment (i.e., ESP and air heater).

Since Crist Unit 6 does not contain post combustion NO_x or SO_2 emissions controls, the baseline sulfuric acid emissions estimate only accounts for the manufacture of H_2SO_4 through combustion and loss or removal within the system. However, since Crist Unit 7 contains post-combustion NOx control (SCR), the baseline sulfuric acid emissions estimate accounts for the manufacture of H_2SO_4 through combustion and through further oxidation of SO_2 in the SCR. Calculated sulfuric acid releases for Crist 7 then accounts for loss or removal within the system. The equations below show how the manufacture and release calculations are made. Table A-1 summarizes these H_2SO_4 emissions calculations.

Sulfuric Acid Manufactured from Combustion (EMComb):
EMComb = K x F1 x E2
where,
EMComb = total sulfuric acid manufactured from combustion, lbs/yr
K = Molecular weight and units conversion constant = 98.07 / 64.04 * 2000 = 3,063
(98.07 = Molecular weight of sulfuric acid; 64.04 = Molecular weight of SO2; Conversion from tons per year to pounds per year – multiply by 2000.)
F1 = Fuel Impact Factor (from the emissions estimating report)
E2 = Sulfur dioxide emissions, tons (from CEMS data).

Sulfuric Acid Manufactured from Combustion is:
Crist 6:
EMComb = 3,063 x 0.008 x 5,662.0 lbs/hr / 2000 = 69.4 lbs/hr
Crist 7
EMComb = 3,063 x 0.008 x 10,177.0 lbs/hr / 2000 = 124.7 lbs/hr

Sulfuric Acid Released from Combustion (ERComb)
ERComb = EMComb x F2 (technology impact factors for air heater and ESP)
ERComb = EMComb x (0.49) x (0.49)
Crist 6
ERComb = 69.4 lbs/hr x (0.24) = 16.7 lbs/hr
Crist 7
ERComb = 124.7 lbs/hr x (0.24) = 29.9 lbs/hr

Sulfuric Acid Manufactured by SCR (EMSCR) [for Crist 7 only]
EMSCR = K * S2 * fs * E2
where,
EMSCR = Total sulfuric acid manufactured from SCR, lbs per year
K = Conversion factor = 3063
S2 = SCR catalyst SO2 oxidation rate (specified as a decimal)
fs = Operating factor of SCR system, fraction of coal burn when SCR operates
E2 = SO2 produced, tons per year
Crist 7:
EMSCR = 3,063 x 0.0075 x 1.0 x 10177.0 / 2000 = 116.9 lbs/hr

Sulfuric Acid Released from SCR (ERSCR) [for Crist 7 only]
ERSCR = [EMSCR – (Ks * B * fs * SNH3)] * F2x
where,
ERSCR = Total sulfuric acid released from SCR, lbs per year
EMSCR = Total sulfuric acid manufactured from SCR, lbs per year
Ks = Conversion factor = 3799
B = Coal burn in TBtu/yr
fs = Operating factor of SCR system, fraction of coal burn when SCR operates
SNH3 = NH3 slip from SCR, ppmv at 3% O2
F2x = Technology Impact Factors, all that apply
Crist 7:
ERSCR = [116.9 – (3,799 x 0.00592 x 1.0 x 0.75)] x 0.24 = 24.0 lbs/hr

Total Sulfuric Acid Released (TSAR):
TSAR = ERComb + ERSCR[Crist 7 only]
Crist 6:
TSAR = 16.7 lbs/hr
Crist 7:
TSAR = 29.9 + 24.0 = 53.9 lbs/hr

<u>Example Acid Mist Calculation:</u> For the Crist Fuel Blend, Crist 6 SCR and Crist 6 Turbine Upgrade projects, the above BART calculations for manufactured and released sulfuric acid mist were slightly modified by substituting CEM and Heat Input data in lieu of coal burn to calculate annual tons of emissions in equation "E2". The SO2 tons projected was calculated using projected CEM SO2 rate, i.e (3.35 lb/mmbtu) and projected future Heat Input from the 2009 Energy Budget.

Future Projected Acid Mist Crist 6 with SCR:

Sulfuric Acid Manufactured from Combustion (EMComb):
EMComb = K x F1 x E2
where,
EMComb = total sulfuric acid manufactured from combustion, lbs/yr
K = Molecular weight and units conversion constant = 98.07 / 64.04 * 2000 = 3,063
(98.07 = Molecular weight of sulfuric acid; 64.04 = Molecular weight of SO2; Conversion from tons per year to pounds per year – multiply by 2000.)
F1 = Fuel Impact Factor (from the emissions estimating report) = 0.008
E2 = Sulfur dioxide emissions from CEM rate and Heat Input =
= FGD Operation (3.35 lb/mmbtu * 21537964.20 mmbtu/yr)/2000 = 36076.09 SO2 tons
= FGD Bypass (2.1 lb/mmbtu * 1689388.8 mmbtu/yr)/2000 = 1773.86 SO2 tons
Thus Sulfuric Acid Manufactured from Combustion is:
Crist 6:
FGD Operation EMComb = 3,063 x 0.008 x 36076.09 = 884009 lbs/year
FGD Bypass EMComb = 3,063 x 0.008 x 1773.86 = 43467 lbs/year

Sulfuric Acid Released from Combustion (ERComb)
ERComb = EMComb x F2 (technology impact factors for air heater (.49) and ESP (.49))
ERComb = EMComb x (0.49) x (0.49)
Crist 6
FGD Operation ERComb = 884009 x (0.49) x (0.49) = **212250 lbs/yr**
FGD Bypass ERComb = 43467 x (0.49) * (0.49) = **10436 lbs/yr**

Sulfuric Acid Manufactured by SCR (EMSCR)
EMSCR = K * S2 * fs * E2
where,
EMSCR = Total sulfuric acid manufactured from SCR, lbs per year
K = Conversion factor = 3063
S2 = SCR catalyst SO2 oxidation rate (0.0075 specified as a decimal)
fs = Operating factor of SCR system, fraction of coal burn when SCR operates assume 1.0 for year time operation.
E2 = SO2 produced, tons per year
Crist 6:
FGD Operation EMSCR = 3,063 x 0.0075 x 1.0 x 36076.09 = 828757.98 lbs/hr
FGD Bypass EMSCR = 3,063 x .0075 x 1.0 x 1773.86 = 40749.99 lbs/yr

Sulfuric Acid Released from SCR (ERSCR)
ERSCR = [EMSCR – (Ks * B * fs * SNH3)] * F2x
where,
ERSCR = Total sulfuric acid released from SCR, lbs per year
EMSCR = Total sulfuric acid manufactured from SCR, lbs per year
Ks = Conversion factor = 3799
B = Projected Heat Input as TBtu/yr
fs = Operating factor of SCR system, fraction of coal burn when SCR operates
SNH3 = NH3 slip from SCR, ppmv at 3% O2

F2x = Technology Impact Factors, all that apply (0.49) * (0.49) = 0.24

Crist 6 FGD Operation:

ERSCR = [828757.98 – (3,799 x 21.537964 x 1.0 x 0.75)] x 0.24 = 184174 lbs/yr

Crist 6 FGD Bypass:

ERSCR = [40749.99 – (3,799 x 1.689388 x 1.0 x 0.75)] x 0.24 = 8624.8 lbs/yr

Total Sulfuric Acid Released (TSAR):

TSAR = ERComb + ERSCR

Crist 6 FGD Operation: 212250 lb/yr + 184174 lb/yr = **396424 lb/yr**

Crist 6 FGD Bypass: 10436 lb/yr + 8624.8 lb/yr = **19060.8 lb/yr**

Crist 6 Total Acid Mist Emitted:

FGD Operation TSAR + FGD Bypass TSAR = 396424 + 19060.8 = **415484.8 lbs/yr or**

= 207.74 tons/yr *

* See cell N21 of the CristEmissionsBaseline(11)Turbine120409.xls worksheet and noted in the answer of Gulf's RAI (January 26, 2010) to FDEP Question #6, Page 4.

Summary of Fuel, CEM, and Stack Test Data for Acid Mist Calculations

	Acid Mist Fuel FAACS Lb/Hr	Acid Mist CEM Lb/Hr	Acid Mist Stack Test Lb/Hr	Acid Mist Fuel FAACS Lb/MMBTU	Acid Mist CEM Lb/MMBTU	Acid Mist Stack Test Lb/MMBTU
Crist 7	18.72	17.35	21.92	0.0036	0.0034	0.0040
Crist 6	9.22	7.95	7.67	0.0028	0.0025	0.0023
Crist 5	1.30	1.43	1.27	0.0017	0.0019	0.0017
Crist 4	1.53	1.26	1.89	0.0021	0.0017	0.0023

Comments: Contains Substituted Daily Fuel Data in Average

Contains Deleted Data Run From Average

Conclusion: The Actual Acid Mist Stack Test compare very well with projected EPRI Projected Acid Mist Calculations using Fuel based or CEM based SO2 rates in the equations.

ATTACHMENT 2

Crist 4-7 NOx Emissions Calculations

Unit 4				
Crist 4 Baseline:				
Highest 24 Month Annual Average over last 5 years =				891 tons
Crist 4 Future Year Emissions after FGD+SNCR Installation	NOx Rate	Max Hr HI	Annual MMBTUs	
FGD / SNCR Operation	0.33	45.71	5719426.80	954 tons/yr
FGD / SNCR By Pass Operation	0.5	45.71	500095.2	125 tons/yr
		total mbtu=	6219522.00	
Total NOx				1079.3 tons/yr
Delta Change in NOx Emissions for Crist Unit 4 without any reduction for demand growth				**189** tons/yr
Unit 5				
Crist 5 Baseline:				
Highest 24 Month Annual Average over last 5 years =				873 tons
Crist 5 Future Year Emissions after FGD+SNCR Installation	NOx Rate	Max Hr HI	Annual MMBTUs	
FGD / SNCR Operation	0.32	45.71	5548424.80	886 tons/yr
FGD / SNCR By Pass Operation	0.5	45.71	500095.2	125 tons/yr
		total mbtu=	6048520.00	
Total NOx				1011.1 tons/yr
Delta Change in NOx Emissions for Crist Unit 5 without any reduction for demand growth				**138** tons/yr
Unit 6				
Crist 6 Baseline:				
Highest 24 Month Annual Average over last 5 years =				2876 tons
Crist 6 Future Year Emissions after FGD+SCR Installation	NOx Rate	Max Hr HI	Annual MMBTUs	
FGD / SCR Operation	0.09	154.365	21537964.20	969 tons/yr
FGD / SCR By Pass Operation	0.5	154.365	1689388.8	422 tons/yr
		total mbtu=	23227353.00	
Total NOx				1391.6 tons/yr
Delta Change in NOx Emissions for Crist Unit 6 SCR Project without any reduction for demand growth.				**-1484** tons/yr
Unit 7				
Crist 7 Baseline:				
Highest 24 Month Annual Average over last 5 years =				1582 tons
Crist 7 Future Year Emissions after FGD+with SCR	NOx Rate	Max Hr HI	Annual MMBTUs	
FGD / SCR Operation	0.09	266.93	34557316.60	1555 tons/yr
FGD / SCR By Pass Operation	0.5	266.93	2921318.4	730 tons/yr
		total mbtu=	37478635.00	
Total NOx				2285.4 tons/yr
Delta Change in NOx Emissions for Crist Unit 7 without any reduction for demand growth.				**703** tons/yr
Crist 4-7 Net NOx Emissions Change	Baseline Crist 4-7 NOx =			6222
	Future Projected without reduction for demand growth =			5767
	Net NOx Change =			-454 tons/yr

CRIST 6 PROJECT DESCRIPTION

Crist Unit 6 HP/IP Turbine Upgrade Project Description

Background: Large high pressure stream turbines like the one at Plant Crist Unit 6 are typically broken down into three sections: High Pressure (HP), Intermediate Pressure (IP) and Low Pressure (LP). Exhaust from the high pressure section in fossil fuel-fired applications is typically returned to the boiler for reheating before being sent to the intermediate turbine. The high and intermediate sections are combined into one casing with opposed flow directions to balance axial forces. The intermediate pressure section is used with steam generators which use a reheat cycle. The low pressure section receives steam flow from a crossover from the intermediate pressure section. The combination of these sections improves the efficiency of the turbine to provide electric generation. The Crist Unit 6 Turbine upgrade project will update the High and Intermediate (HP/IP) sections to improve efficiency and produce approximately 9 additional megawatts of generation while using the same amount of fuel and steam flow. The Crist Unit 6 Turbine upgrade is scheduled to be installed in spring of 2012.

SCOPE OF WORK

The Crist Unit 6 turbine upgrade represents a significant opportunity to improve plant efficiency. The BB43PA upgrade product is based on many years of design experience with combined HP/IP flow applications and incorporates the latest in technological improvements to provide advantages to the customer:

- Significantly improve performance
- Eliminate reliability issues
- Minimize installation and maintenance scope
- Increase operational flexibility and reduce start-up times

Key design features have been incorporated into the BB43PA design to achieve higher efficiencies and best-in-class reliability:

- Eliminate 180° turn around inlet to HP reaction blade path to reduce pressure losses
- Optimized HP inlet duct section to reduce flow separation and pressure losses
- Floating nozzle chamber design allows unrestrained thermal expansion and eliminates risk of weld cracking
- Slide-in nozzle block design eliminates bolting and risk of loose bolting damaging bladepath
- Contoured end wall nozzle block flow passage design reduces solid particle erosion (SPE) and risk of vane chipping
- Robust nozzle block foil sections with thicker trailing edges, improved materials, improved airfoil profile, boride diffusion coating, and wide-pitch vanes reduce effects of SPE and risk of vane chipping
- Modernized high efficiency Rateau control stage design with proven triple pin rotating blades

- Reduced pressure drop across control stage reduces steam velocities and SPE
- Latest 3D airfoil technology and springback sealing
- Integrally shrouded T-root reaction blading
- Single-piece integral inner cylinder to allow independent alignment and eliminate separately supported blade rings (3) and LP dummy rings (3).
- Integral inner cylinder allow for over 50% reduction in bolting and hardware
- Single-piece outer cylinder with integral gland rings and IP exhaust flow guide

The original BB43 design consisted of a combined HP and split-flow IP arrangement. By providing a new outer cylinder design, the BB43PA can be re-configured as a combined HP and straight-flow IP element. This arrangement provides significant performance benefits by removing the multiple leakage paths and associated losses of the split-flow design and allowing unconstrained design of the HP and IP blade paths. The greater available axial and radial space of the new design allows for optimal blade heights and higher stage counts to be utilized and results in highly efficient HP and IP blade paths.

EMISSIONS ANALYSIS SUMMARY

The proposed Crist 6 Turbine Upgrade Project will not significantly increase regulated emissions at Plant Crist. The project will increase the efficiency of the steam turbine and will not increase the heat input capacity of the Unit. A higher sulfur fuel blend case is included in the Emissions Analysis Worksheet attached in the application. The fuel blend case is being addressed in a separate air construction application and is being included in this application only for informational purposes.

Crist 6 FCYCLE Model Results

		Case 1 Normal Full Current Turbine	Case 3 Partial Arc Turbine Design Constant Heat Input
Gross Unit Load	MW	320.0	328.9
Station Service	MW	21.5	21.8
Heat Input	Btu	3010.6	3010.6
Gross Plant Heat Rate	B/K	9408	9154
Net Plant Heat Rate	B/K	10084	9804
Main Steam Flow	lb/hr	2,260,999	2,245,290
Superheat Temp	F	1000	1000
Reheat Temp	F	1000	981
Superheat Spray Flow	lb/hr	109,000	112,000
Reheat Spray Flow	lb/hr	0	0
	F		
HP Efficiency	%	76.9	88.2
IP Efficiency (True)	%	90.0	92.7
Condenser Pressure		3.5	3.5

Partial arc throttles steam with the governor valves operating sequentially at reduced loads making unit more efficient.

7009 1680 0001 7427 5713

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT OF THE RETURN ADDRESS, FOLD AT DOTTED LINE

CERTIFIED MAIL

7009 1680 0001 7427 5713

7009 1680 0001 7427 5713

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$
Certified Fee	
Return Receipt Fee (Endorsement Required)	
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$

Postmark Here

Sent To

Street, Apt. No.; or PO Box No.

City, State, ZIP+4

PS Form 3800, August 2006 See Reverse for Instructions

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number
(Transfer from service label)

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540