Coal Creek Station Units 1 and 2
June 7, 2012 Technical Update

to

"Supplemental Best Available Retrofit Technology Refined Analysis for NOx Emissions," April 5, 2012

Coal Creek Station Technical Update to Supplemental BART Analysis for NOx Emissions

June 7, 2012

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1.0 Introduction

In December 2007, GRE submitted its final Best Available Retrofit Technology (BART) evaluation for Regional Haze controls to the North Dakota Department of Health (NDDH). The NDDH incorporated the proposed emission limits for Coal Creek Station (CCS) Units 1 and 2 into their proposed State Implementation Plan (SIP) and issued a draft Permit to Construct (PTC) for these BART emission limits. As part of their review of North Dakota's draft SIP, EPA requested supplemental data and documentation concerning Coal Creek's BART analysis. GRE provided the requested information.

On September 21, 2011, EPA proposed a Federal Implementation Plan (FIP), which would override certain NDDH determinations, particularly with respect to required NOx emission limits for certain coal-fired utility units. On November 3, 2011, NDDH requested that GRE provide a supplemental BART analysis that is focused on NOx control options at Coal Creek Station. In particular, GRE performed more refined analyses on selective non-catalytic reduction (SNCR) cost assumptions, achievable control levels and the overall impacts to beneficial use of ash for Coal Creek Station Units 1 and 2. An updated refined analysis was provided to address questions from NDDH on January 19, 2012. In response to questions from NDDH, a complete supplemental submittal was provided to NDDH on April 5, 2012.

Based on these refined analyses, Great River Energy still asserts that use of its state-of-the-art coal drying technology, DryFining™, in conjunction with second generation combustion control low-NOx burners with separated overfire air (LNC3+), meets EPA's presumptive BART NOx limit of 0.17 lb/MMBtu, and is consistent with cost effective thresholds. When all factors are adequately considered, including ammoniated ash impacts and incremental improvements in visibility, SNCR is not considered cost effective for Coal Creek Station given the lack of resulting incremental visibility improvements in the affected Class I areas.

This technical update is issued in response to additional inquiries from NDDH. This technical update, in conjunction with the April 5 supplemental submittal, provides the complete refined analysis of BART controls for Coal Creek Station.

Update to Section 2.2 Revision of Baseline NOx Emissions

Although GRE does not concede that NDDH's BART analysis may disregard any existing controls in use at a unit, GRE has nonetheless calculated a revised baseline for Unit 2 of 0.201 lb. NOx/MMBtu at NDDH's request. This value represents the baseline emissions for Unit 2 taking into consideration the installation of DryFining™ technology while not including the emission reductions gained through the installation of the LNC3+ tuning. The LNC3+ technology was installed in Unit 2 prior to the installation of the DryFining technology and is currently in use. Since Unit 2 has not operated with a DryFining-only configuration, we must utilize the information from Unit 1's emissions baseline as a surrogate for the projected baseline for the operation of LNC3+ as a stand-alone technology.

Update to Section 3.1 SNCR Control Cost Analysis

This technical update has modified the precision of some of the numbers in Table 3.1. The operating scenario utilized to calculate cost effectiveness was based on averaging data from outage and non-outage years, which GRE believes most accurately reflects real-world conditions. To portray the most-conservative, worst-case conditions the operating hours have been adjusted to portray a non-outage year. Due to the change in the baseline and operating hours, the control efficiency value has increased to 39 percent for the LNC3+ with SNCR technology combination in all lost ash sale scenarios. Although the recalculations have lowered the values for cost-effectiveness they remain above EPA's presumptive cost-effectiveness thresholds, and when all factors are considered GRE's conclusion that the installation of SNCR is not cost effective remains valid. Revised Table 3.1 is below.

Table 3.1 Control Cost Summary (2011$)

Unit ID	Control Description	NOx Emissions (lb/MMBtu)	Control Eff. From Baseline (%)	Emission Reduction from Baseline (T/yr)	Installed Capital Cost ($MM)	Annualized Operating Cost ($MM)	Pollution Control Cost ($/ton)	Incremental Cost $/ton
Unit 1	SNCR,LNC3+,100% Lost Ash Sales (Scenario B)	0.122	39%	1,994.3	$17.87	$8.879	$4,452	$10,457
	SNCR,LNC3+,30% Lost Ash Sales (Scenario C)					$6.604	$3,311	$7,524
	SNCR,LNC3+,No Ash Impacts (Scenario A)					*$4.385*	*$2,199*	*$4,666*
	SNCR, 100% Lost Ash Sales (Scenario B)	0.151	25%	1,270.0	$12.18	$9.101	$7,167	NA – Inferior Control
	SNCR, 30% Lost Ash Sales (Scenario C)					$6.826	$5,375	
	SNCR, No Ash Impacts (Scenario A)					*$4.608*	*$3,628*	
	LNC3+	0.153	24%	1,218.2	$6.08	$0.764	$627	$627
	Baseline (LNC3)	0.201	NA-Base	NA-Base	NA-Base	NA-Base	NA-Base	NA-Base
Unit 2	SNCR,LNC3+,100% Lost Ash Sales (Scenario B)	0.122	39%	1,996.6	$17.87	$8.879	$4,447	$10,444
	SNCR,LNC3+,30% Lost Ash Sales (Scenario C)					$6.604	$3,307	$7,516
	SNCR,LNC3+,No Ash Impacts (Scenario A)					*$4.385*	*$2,196*	*$4,661*
	LNC3+	0.153	24%	1,219.6	$6.08	$0.764	$627	$627
	Baseline – LNC3	0.201	NA-Base	NA-Base	NA-Base	NA-Base	NA-Base	NA-Base

A "No Ash Impacts" scenario is provided for reference only as it does not represent a feasible control option.

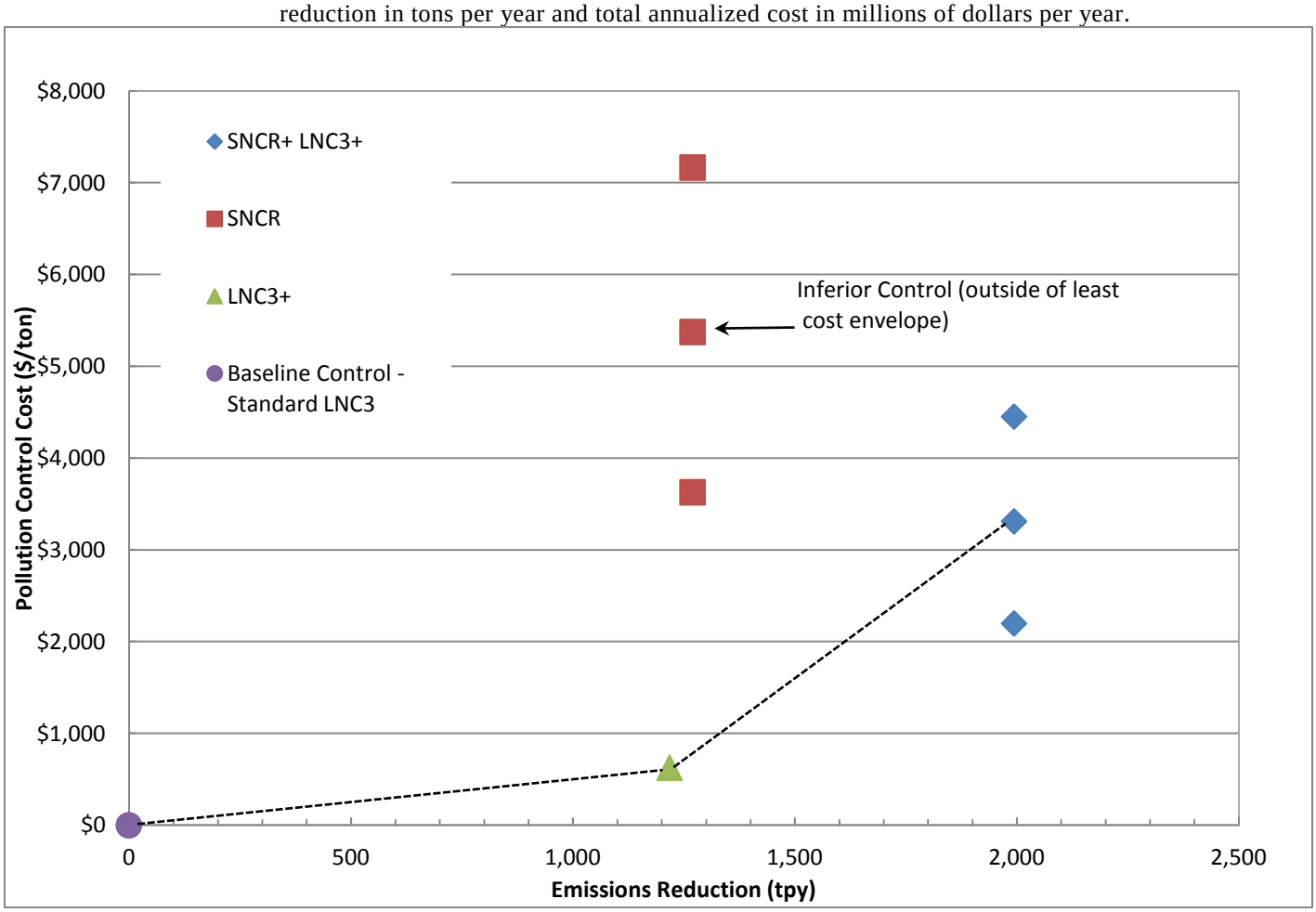
GRE takes this opportunity to reiterate that the controlled NOx emission concentrations and mass rates have been evaluated on an annual average basis and are not representative of anticipated operation on a shorter scale averaging period (30-day rolling or 24-hour rolling), consistent with BART guidance that costs be normalized to the expected annual emissions reduction. The 30-day rolling limits are intended to be inclusive of unit startup and shutdown as

well as variability in load. Consequently, associated BART limits must be higher than stated annual averages used for estimating cost effectiveness (e.g., LNC3+ is evaluated at 0.153 lb. NOx/MMBtu on an annual average basis with an anticipated 30-day rolling limit of 0.17 lb. NOx/MMBtu). Section 2.2.2 Load Variability in the April 5, 2012 submittal summarizes these effects.

The modified baseline has also shifted the values for the least cost envelope graph which we have supplied for the sake of completeness. The assumptions concerning this table remain the same. Following the graph for least cost LNC3+ would be installed prior to installing any additional technology. The installation of SNCR alone would be an inferior technology and is deemed not cost effective.

Figure 3.1 Incremental NOx Analysis

The remaining feasible technologies are illustrated on the basis of annualized emissions reduction in tons per year and total annualized cost in millions of dollars per year.



3.3 SNCR Visibility Impacts

Table 3.2 Difference in Impairment and Incremental Cost for LNC3+ with Tuning and SNCR with LNC3+

Unit ID	2000 (dV)	2001 (dV)	2002 (dV)	Average (dV)	Incremental Cost per dV (MM$/dV)[1]
Unit 1	0.031	0.044	0.093	0.056	$103.81
Unit 1 & 2	0.062	0.083	0.172	0.106	$110.26

[1] Incremental cost comparison (2011$) of LNC3+ with SNCR with LNC3+ at 30% lost ash sales

The visibility analysis demonstrates that SNCR will not result in actual improvement to visibility in North Dakota's affected Class I areas, and potential modeled improvements will come at a prohibitive incremental cost exceeding $100 million (2011$) per deciview. Utilities in North Dakota only contribute ~6 percent to total NOx emissions in the State. Consequently, any additional utility NOx reductions will not have an appreciable effect on visibility improvement. Additional details regarding modeling inputs and visibility impairment is presented in Appendix D to the April 5, 2012 submittal.

4.0 Conclusions of Technical Update

In evaluating the impacts of Unit 1's technologies it was concluded that installation of SNCR alone (without LNC3+) is an economically inferior technology and therefore is not further evaluated incrementally. When the SNCR and LNC3+ technologies were evaluated together for Unit 1 and Unit 2 they were deemed not cost effective on an incremental basis and therefore not an appropriate BART technology. GRE included the visibility tables for the associated LNC3+, and SNCR cases presented in Table 3.1. The final conclusion for the visibility impacts is that, based on our refined analysis, the state Class I areas would not see any economically justifiable improvements in visibility by requiring a level of NOx control above LNC3+ for Coal Creek Station, and additional reductions would be cost prohibitive on a dollar per deciview basis (Table 3.2).

The refined analysis and subsequent updates clearly demonstrate that the presumptive NOx limit of 0.17 lb/MMBtu is both cost effective and results in significant visibility improvements in North Dakota's Class I areas.

Appendix A

Updated Pollution Control Cost Evaluations