Nevada Division of Environmental Protection-Bureau of Air Quality Planning (NDEP-BAQP) BART Determination Review of Nevada Energy's Fort Churchill Generating Station Units 1 and 2

BOLD text below identifies the Guidelines for BART Determinations under the Regional Haze Rule in Appendix Y of 40 CFR 51

Background
A BART analysis was completed by CH2M HILL at the request of Nevada Energy (NVE) for Units 1 and 2 at the Fort Churchill Generating Station (Ft. Churchill) dated October 3, 2008. Ft. Churchill consists of two BART-eligible units with a generating capacity of 113 megawatts each. The fuel currently utilized in Units 1 and 2 is pipeline quality natural gas (PNG) or blended fuel oil. In completing the BART analysis, technology alternatives were investigated and potential reductions in NO_x, SO_2, and PM_{10} emissions rates were identified. NVE's BART analysis is summarized below and organized according to the five step analysis contained in Appendix Y of 40 CFR 51 for sources subject to BART.

STEP 1 – Identify all available retrofit emissions control techniques; alternatives can be categorized in three ways:

- **Pollution prevention (use of inherently lower-emitting processes/practices);**
- **Use of (and where already in place, improvement in the performance of) add-on controls; or**
- **Combination of pollution prevention and add-on controls.**

NVE identified the following emission reduction scenarios:

Potential NO_x Control Options – (Current controls consist of good combustion practices)

- Low NO_x Burners (LNB)
- LNB with Flue Gas Recirculation (FGR)
- LNB with Selective Non-Catalytic Reduction (SNCR) System
- Rotating Opposed Fire Air (ROFA) with Rotamix
- LNB with Selective Catalytic Reduction (SCR) System

Potential SO_2 Control Options – (No SO_2 controls currently implemented)

- Use of low sulfur distillate (No. 2 fuel oil)
- Spray Dryer Absorber (SDA)

Potential PM_{10} Control Options – (No PM_{10} controls currently implemented)

- Use of low sulfur fuel oil (No. 2 fuel oil)
- Dry Electrostatic Precipitator (dry ESP)
- Wet Electrostatic Precipitator (wet ESP)
- Fabric Filter

STEP 2 – Eliminate technically infeasible options based on:

- **Availability (commercial availability); and**

- **Applicability (has it been used on the same or a similar source type).**

NO_x

Technical feasibility for the proposed control options were based on physical constraints, boiler configuration and emission reduction potential. However, the installation of over-fire air (OFA) was the only control option eliminated due to the potential cost of boiler wall changes.

SO_2

Technical feasibility for the proposed control options were based on fuel storage delivery constraints, boiler configuration, and the emission reduction potential of low sulfur fuel oil. None of the control options were eliminated.

PM_{10}

Technical feasibility for the proposed control options was based on physical, chemical, and emissions reduction potential. Dry ESP was eliminated due to the uncertainty in chemical and physical characteristics of the oil-fired particulate and the increased loading from SDA. Likewise, wet ESP was eliminated due to the potential increased particulate loading from an SDA not allowing the wet ESP to meet the required control efficiency. Fabric filter is expected to function properly only with pre-coating and the increased particulate loading from the SDA operation. NVE noted that the current baseline PM_{10} emissions while burning PNG or No. 2 fuel oil already meet BACT emissions levels.

STEP 3 – Evaluate control effectiveness of remaining control options:

- **Make sure you express the degree of control using a metric that ensures an "apples to apples" comparison of emissions performance levels among options (e.g., lb SO_2/MMBtu); and**
- **Give appropriate treatment and consideration of control techniques that can operate over a wide range of emission performance levels (evaluate most stringent control level that the technology is capable of achieving plus other scenarios).**

NO_x

NVE estimates the following control efficiencies with each control option:

1) 49.5 percent for LNB and an emissions level of 0.26 lb/MMBtu (PNG) and 0.22 lb/MMBtu (No. 2 fuel oil).
2) 56.7 percent for LNB with FGR and an emissions level of 0.12 lb/MMBtu (PNG) and 0.14 lb/MMBtu (No. 2 fuel oil).
3) 62.1 percent for LNB with SNCR and an emissions level of 0.20 lb/MMBtu (PNG) and 0.17 lb/MMBtu (No. 2 fuel oil).
4) 65.7 percent for ROFA with Rotamix and an emissions level of 0.15 lb/MMBtu (PNG & No. 2 fuel oil).
5) 87.4 percent for LNB with SCR and an emissions level of 0.07 lb/MMBtu (PNG & No.2 fuel oil).

SO_2
SDA is estimated to achieve 90 percent control efficiency and meet an emissions level of 0.10 lb/MMBtu. Conversion to low sulfur fuel is estimated to achieve 93 percent control efficiency and meet an emission level of 0.05 lb/MMBtu.

PM_{10}
Fabric filter is estimated to achieve 46 percent control efficiency and meet an emissions level of 0.015 lb/MMBtu. Control efficiency for conversion to low sulfur fuel and the utilization of LNB is estimated to meet an emission level of 0.03 lb/MMBtu.

STEP 4 – Impact analysis:

- **Cost of compliance (identify emission units, design parameters, develop cost estimates);**
  - **Baseline emissions rate should represent a realistic depiction of anticipated annual emissions for the source. In general, for the existing sources subject to BART, you will estimate the anticipated annual emissions based upon actual emissions from a baseline period.**
- **Energy impacts;**
  - **Direct energy consumption for the control device, not indirect energy impacts.**
- **Non-air quality environmental impacts;**
  - **Solid or hazardous waste generation or discharges of polluted water from a control device.**
- **Remaining useful life;**
  - **Can be included in the cost analysis.**

Costs of Compliance
Control options cost comparisons are presented in Tables 3-3, 3-5 and 3- 7 of each NVE BART determination report. A complete economic analysis for NO_x, SO_2 and PM_{10} is presented in the appendix to each NVE BART determination report.

Energy Impacts
The installation of LNB is not expected to impact boiler efficiency or forced draft fan power usage substantially. No energy impact is associated with switching to No. 2 fuel oil; however additional system pressure drop will result from installation of SDA. There is no additional energy impact from PM_{10} reduction as a result of LNB or burning No. 2 fuel oil. Fabric filter and ductwork will add a pressure drop to the system. No energy impact costs for are included for SO_2 and PM_{10} control options in the economic analysis presented in the appendix to each NVE BART determination report.

Environmental Impacts
SNCR, Rotamix and SCR installation could potentially create a visible stack plume, which may impact visibility improvements. Transport of ammonia to the site may be an issue in the event of an accidental release. No environmental impact is associated with switching to No. 2 fuel oil or installation of an SDA. No negative environmental impacts

are expected from the utilization of new LNB, switching to low sulfur fuel, or utilizing a fabric filter.

Remaining Useful Life
The remaining useful life is estimated to be 23 years from the installation of BART controls for Units 1 and 2.

STEP 5 – Determine visibility impacts (improvements):

- **Run the model at pre-control and post-control emission rates;**
- **Determine net visibility improvement;**
- **Compare 98th percentile.**

Modeling for pre-control and post-control emission rates demonstrates an improvement in visibility based on the BART conclusions presented by NVE for Units 1 and 2 at Tracy. The NO_x emission rate (0.40 lb/MMBtu) modeled is in excess of the proposed NVE BART limit (0.28 lb/MMBtu - annual). Subsequently, the modeling results represent worst case visibility impacts at the higher rate. Modeling results for other technically feasible control options were not presented.

NDEP Analysis:

Based on the information provided in NVE's October 3, 2008 BART determination reports, NDEP concurs with each BART determination for Units 1 and 2 at Ft. Churchill, with the exception of the installation of only LNB for control of NO_x emissions. For both units, BART for SO_2 is PNG and/or No. 2 fuel oil with an emission limit of 0.05 lb/MMBtu, 24-hr average. For PM_{10}, BART is also PNG and/or No. 2 fuel oil but with an emission limit of 0.03 lb/MMBtu, 3-hr average.

For NO_x, NDEP established a baseline emissions scenario using Acid Rain Data from calendar years 2002 through 2007. NDEP used the average of the highest two consecutive NO_x annual emissions to establish the NO_x baseline emissions. NVE's cost and control efficiencies presented for each control technology were taken at face-value and used in NDEP's BART determination. The control technologies were ordered in range of efficiency from highest to lowest control efficiency. NDEP's economic analysis summary is presented in Table 1.

TABLE 1

NDEP ECONOMIC ANALYSIS SUMMARY

Ft. Churchill 1

		NOx Control				
	Current Operation (Uncontrolled)	LNB w/SCR	ROFA w/Rotamix	LNB w/SNCR	LNB w/FGR	LNB
Capital Cost	$0	$35,781,250	$5,250,940	$4,416,563	$1,610,000	$1,050,000
First Year O&M Cost	$0	$705,037	$695,193	$424,800	$320,219	$45,200
First Year Debt Service	$0	$3,794,816	$974,564	$468,403	$170,750	$111,359
Total Annual Cost	$0	$4,499,853	$1,669,757	$893,203	$490,969	$156,559
Base Heat Input (MMBtu)	5,472,541					
Total Heat Input allowed (MMBtu)	11,561,448					
Base emissions (tons)	1209					
NOx Removal Rate %	0.0%	87.4%	65.7%	62.1%	56.7%	49.5%
NOx Removed (Tons)	0	1057	794	751	686	598
NOx Emission Rate (Tons)	1209	152	415	458	524	611
NOx Emission Rate (lb/MMBtu)		0.056	0.152	0.167	0.191	0.223
First Year Cost ($/ton removed)		**$4,259**	**$2,102**	**$1,190**	**$716**	**$262**
Incremental Cost ($/ton)		**$10,787**	**$17,842**	**$6,161**	**$3,842**	**$262**

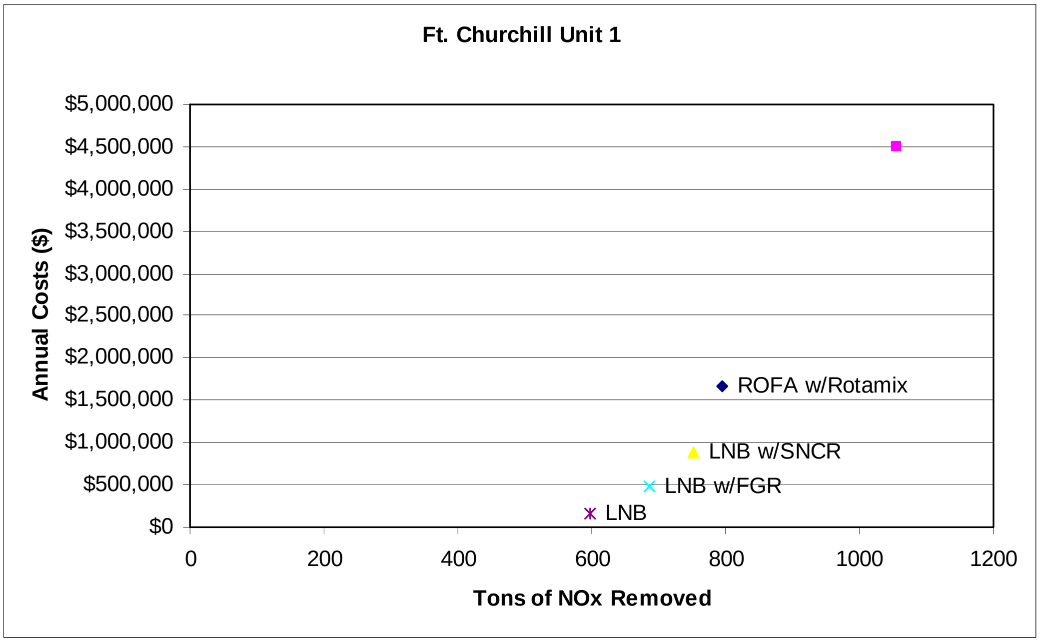
Ft. Churchill 2

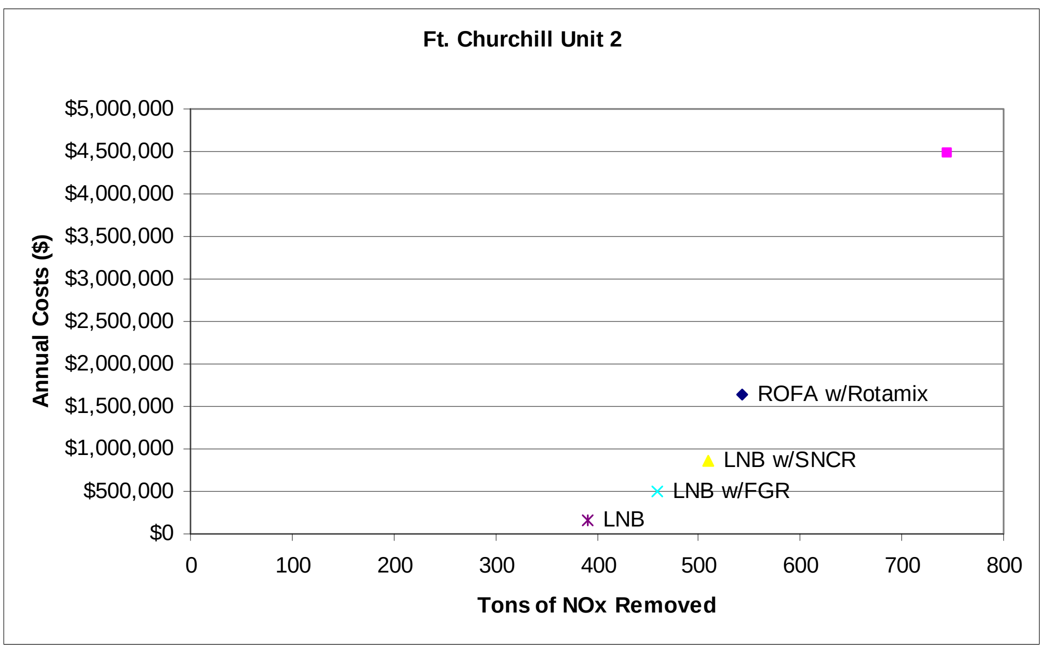
		NOx Control				
	Current Operation (Uncontrolled)	LNB w/SCR	ROFA w/Rotamix	LNB w/SNCR	LNB w/FGR	LNB
Capital Cost	$0	$35,781,250	$9,189,145	$4,416,563	$1,610,000	$1,050,000
First Year O&M Cost	$0	$685,698	$664,514	$393,739	$320,219	$45,200
First Year Debt Service	$0	$3,794,816	$974,564	$468,403	$170,750	$111,359
Total Annual Cost	$0	$4,480,514	$1,639,078	$862,142	$490,969	$156,559
Base Heat Input (MMBtu)	5,197,003					
Total Heat Input allowed (MMBtu)	11,561,448					
Base emissions (tons)	862					
NOx Removal Rate %	0.0%	86.4%	63.0%	59.1%	53.2%	45.4%
NOx Removed (Tons)	0	745	543	510	459	391
NOx Emission Rate (Tons)	862	117	319	353	404	471
NOx Emission Rate (lb/MMBtu)		0.045	0.123	0.136	0.155	0.181
First Year Cost ($/ton removed)		**$6,014**	**$3,017**	**$1,692**	**$1,070**	**$400**
Incremental Cost ($/ton)		**$14,082**	**$23,103**	**$7,296**	**$4,972**	**$400**

NDEP specifically reviewed the cost per ton of NO_x removed for each unit at Ft. Churchill and determined that installation of LNB with FGR meets the BART criteria, with associated costs of $716 to $1,070/ton of NO_x removed for Units 1 and 2, respectively. These values are considered cost effective. The cost data from the tables above are presented graphically in Figure 1. NDEP also concluded based on a review of the economic analysis that the $/ton of NO_x removed increased significantly for LNB with SNCR, ROFA and SCR technologies without any clear environmental benefit.

FIGURE 1

LEAST COST ENVELOPE





Visibility improvement upon installation of LNB with FGR is anticipated to be greater than modeling with NVE's proposed BART limit presented in their October 2008 Report. Modeling the visibility impact based upon the emission rates presented in Table 1 will be performed at a later date. Thereafter, data will be added to this report. Based on this review, NDEP concludes that for NO_x the installation of LNB with FGR with an emission level at 0.20 lb/MMBtu for Unit 1 and 0.16 lb/MMBtu for Unit 2, on a 12-month rolling average, is BART.