Attachment A
BART Screening Modeling Analysis for P.H. Robinson Electric Generating Station NRG Texas LP

INTRODUCTION

The Best Available Retrofit Technology (BART) requirements may potentially apply to major sources of visibility-impairing air pollutants that were not in operation prior to August 7, 1962, but were in existence on August 7, 1977. CDM understands that initial screening modeling for visibility impairment as conducted by the Texas Commission on Environmental Quality (TCEQ) for NRG Texas LP (NRG Texas) inadvertently left out two units at the P.H. Robinson Station; therefore, NRG Texas could not provide certification by February 28, 2007 that modeling inputs as used by the TCEQ were correct. As a result, NRG Texas must demonstrate that the source does not contribute to visibility impairment at a Class I area, or failing that, submit an analysis of emissions control alternatives and BART control strategy and implementation plan by April 30, 2007.

This report outlines the modeling performed to demonstrate that the source does not contribute to visibility impairment at a Class I area. The modeling methodology and results are presented below.

MODELING METHODOLOGY

Approach

In conducting the modeling analyses, CDM closely followed the guidance outlined in the TCEQ's "Best Available Retrofit Technology (BART) Modeling Protocol to Determine Sources Subject to BART in the State of Texas"(Guidance). NRG Texas' modeling protocol for this study was previously submitted to TCEQ on April 18, 2007[1].

Modeling was conducted using the most recent available EPA version of the CALPUFF modeling system as developed by TRC Companies, Inc. (TRC). This system uses Version 5.711a Level 040716 of the CALPUFF dispersion model. The CALPOST postprocessor was used to calculate the visibility impacts. A preprocessed CALMET data file was obtained from the Oklahoma Department of Environmental Quality and used without modification. Therefore, the CALMET meteorological model was not used.

Since the default version of the model assumes a maximum computational grid size of 265 x 265, and the Guidance uses a grid size of 306 x 246, the base CALPUFF code obtained from TRC

[1] *BART Modeling Protocol for NRG Texas LP*, letter to Mr. Daniel Jamieson, TCEQ from Mr. Vincent Tino, CDM, April 18, 2007.

was recompiled. TCEQ provided working CALPUFF and CALPOST model executables for use in this analysis. The executables are provided to TCEQ with the inputs and outputs on digital media for their review.

Model Inputs

Since the source is subject to the Clean Air Interstate Rules (CAIR), an exemption is provided by the regulations for sulfur dioxide (SO_2) and oxides of nitrogen (NO_X); therefore, only particulate matter (PM) emissions were modeled. According to the screening analysis requirements, the maximum 24-hour emissions that occurred during the period of 2002-2005 must be modeled. Since daily emissions are not generally available, the EPA has suggested that annual average hourly rates be doubled to provide an estimate of maximum hourly rates over a 24-hour period. It was assumed that all PM is PM2.5 and that this assumption would be conservative in assessing long range visibility impacts, since larger particles would be expected to deposit well short of the assessed impact areas. To avoid "double-counting," PM10 emissions were not modeled.

For the P.H. Robinson Station, the following PM emission rates are reported from the 2002 emission inventory and were used as the basis for this modeling study. The emission rates are shown below:

Unit/Description	2002 Emissions Inventory Data		CALPUFF Model Input	
	Yearly (tpy)	Average Daily (lb/day)	Maximum Daily (lb/day)	Maximum Daily (g/s)
PHR1A Boiler 1 Stack A	29.0	158.9	158.9	0.834
PHR1B Boiler 1 Stack B			158.9	0.834
PHR2A Boiler 2 Stack A	31.0	169.9	169.9	0.892
PHR2B Boiler 2 Stack B			169.9	0.892
PHR3 Boiler 3	28.3	155.1	310.2	1.628
PHR4 Boiler 4	29.5	161.6	323.2	1.697
PHRAB3 Auxiliary Boiler 3	0.4	2.2	4.4	0.023
PHRAB4 Auxiliary Boiler 4	0.3	1.6	3.2	0.017
PHRACT1 Cooling Tower 1	0.7	3.8	7.6	0.039
PHRACT2 Cooling Tower 2	0.8	4.4	8.8	0.046

Unit/Description	2002 Emissions Inventory Data		CALPUFF Model Input	
	Yearly (tpy)	Average Daily (lb/day)	Maximum Daily (lb/day)	Maximum Daily (g/s)
PHRACT3 Cooling Tower 3	0.7	3.8	7.6	0.039
PHRACT4 Cooling Tower 4	0.9	4.9	9.8	0.051

The following stack location information was used for each unit.

Unit	Latitude (°N)	Longitude (°W)	LCC – X (km)	LCC – Y (km)	Base Elevation (m)
PHR1A	29.4864	94.9792	197.52906	-1162.59452	3
PHR1B	29.4861	94.9792	197.52980	-1162.62803	3
PHR2A	29.4858	94.9792	197.53055	-1162.66155	3
PHR2B	29.4857	94.9794	197.51125	-1162.67315	3
PHR3	29.4847	94.9793	197.52351	-1162.78464	3
PHR4	29.4847	94.9800	197.45509	-1162.78616	3
PHRAB3	29.4844	94.9794	197.51448	-1162.81837	3
PHRAB4	29.4847	94.9803	197.42577	-1162.78681	3
PHRACT1	29.4856	94.9792	197.53105	-1162.68389	3
PHRACT2	29.4856	94.9792	197.53105	-1162.68389	3
PHRACT3	29.4853	94.9797	197.48292	-1162.71848	3
PHRACT4	29.4856	94.9792	197.53105	-1162.68389	3

LCC – Lambert Conformal Conic projection

The following physical stack parameters were used for each unit.

Unit	Stack Height	Stack Diameter	Gas Exit Velocity	Gas Exit Temperature
PHR1A	189 ft 57.61 m	15 ft 4.572 m	53 f/s 16.154 m/s	264 °F 402.04 K
PHR1B	189 ft 57.61 m	15 ft 4.572 m	53 f/s 16.154 m/s	264 °F 402.04 K
PHR2A	189 ft 57.61 m	15 ft 4.572 m	53 f/s 16.154 m/s	264 °F 402.04 K
PHR2B	189 ft 57.61 m	15 ft 4.572 m	53 f/s 16.154 m/s	264 °F 402.04 K
PHR3	176 ft 55.64 m	23 ft 7.010 m	59.4 f/s 18.11 m/s	276 °F 408.71 K
PHR4	215 ft 65.53 m	26 ft 7.925 m	58 f/s 17.678 m/s	251 °F 394.82 K

Unit	Stack Height	Stack Diameter	Gas Exit Velocity	Gas Exit Temperature
PHRAB3	176 ft 55.64 m	5.5 ft 1.676 m	50.4 f/s 15.362 m/s	475 °F 519.26 K
PHRAB4	215 ft 65.53 m	9 ft 2.743 m	27 f/s 8.230 m/s	300 °F 422.04 K
PHRACT1	45.2 ft 13.777 m	18 ft 5.486 m	27.6 f/s 8.412 m/s	78 °F 298.71 K
PHRACT2	45.2 ft 13.777 m	18 ft 5.486 m	27.6 f/s 8.412 m/s	78 °F 298.71 K
PHRACT3	45.2 ft 13.777 m	18 ft 5.486 m	27.6 f/s 8.412 m/s	78 °F 298.71 K
PHRACT4	22 ft 6.706 m	14 ft 4.267 m	15 f/s 4.572 m/s	78 °F 298.71 K

Since only PM was modeled, there can be no chemical transformation of this pollutant. Thus the option to include chemical transformation (CALPUFF variable MCHEM) was unselected, and any of the chemical transformation parameters (CALPUFF Input Group 11) was set accordingly. Also, since long-range impacts are required, building downwash was not included.

Contrary to the Guidance, each yearly run started with hour zero on January 1st (rather than hour 1 as stated in the Guidance). Thus the IBHR variable was set to "0" in each CALPUFF input file. All other model input control parameters were set according to the values stated in Appendix B of the Guidance.

Meteorological Data

The modeling required an extensive 3-year (2001-2003) CALMET formatted meteorological database produced by the Central Regional Air Planning Association (CENRAP) for their southern territory. This data file covers roughly a 2000 by 2000 km area with a 6 km horizontal grid resolution, and 11 levels in the vertical dimension. This area covers the entire states of Texas, Oklahoma, Arkansas, and Louisiana, as well as parts of New Mexico, Colorado, Kansas, Missouri, Mississippi, Tennessee, Kentucky and Illinois, and extends well into Mexico and the Gulf of Mexico.

This database requires approximately 250 gigabytes of data storage. It was obtained from the Oklahoma Department of Environmental Quality via USB external hard drive and used without modification. To accommodate CALPUFF's use of the MS-DOS 8.3 file name format, the individual CALMET file names were changed to recognizable file names in 8.3 format.

Each year was modeled separately. Years 2001 and 2002 contained 8760 hours and year 2003 contained 8748 hours.

Class I Areas

There are twenty Class I areas shown in the Guidance which are to be considered. It can be presumed that it is likely that the closest areas would fail with this screening modeling before areas farther away. To speed runtime and conserve disk space, CDM included only those areas closest to the facility.

The Class I areas included are:

Class I Area	Number of Receptors
Big Bend National Park (National Park Service)	480
Breton Wilderness Area (Fish & Wildlife Service)	40
Caney Creek Wilderness Area (U.S. Forest Service)	80
Carlsbad Caverns National Park (National Park Service)	256
Guadalupe Mountains National Park (National Park Service)	127
Salt Creek Wildlife Refuge (Fish & Wildlife Service)	55
Wichita Mountains Wildlife Refuge (Fish & Wildlife Service)	59

The receptors were extracted from the *"NPS Convert Class I Areas"* program. The program allows the user to select multiple U.S. National Parks and Monuments, U.S. Fish and Wildlife Preserves, and U.S. Forest Service Wilderness areas and export a consistent set of receptors for each area in a coordinate system specified by the user. This allows the same receptors to be analyzed for each submitted analysis and provides an easy mechanism for the modeler to convert the receptors into useable coordinates. The coordinates Elevations at each receptor are also provided by the program.

A total of 1097 receptors were modeled.

Figure 1 shows the locations of the chosen receptors (green) relative to the source locations (red). These locations were chosen based on their distance from the source facility and their location with respect to other Class I areas. It is assumed that any receptors beyond the modeled receptors will not experience negative visibility impacts if the modeled receptors do not experience negative visibility impacts.

The remaining Class I area receptors were not included in the analysis (black).

Terrain was included in the geographic elevations of the receptors and the sources. No CALPUFF complex terrain inputs (input group 6) were modified from their settings shown in the Guidance.

Postprocessing

Postprocessing of the CALPUFF CONC.DAT file was performed with the CALPOST utility using input parameters specified in Appendix D of the Guidance. Since NO_X was not being

LCC Origin: 40N, 97W
Matching Parallels: 33N
False Easting: 0
False Northing: 0
Datum: WGS-84

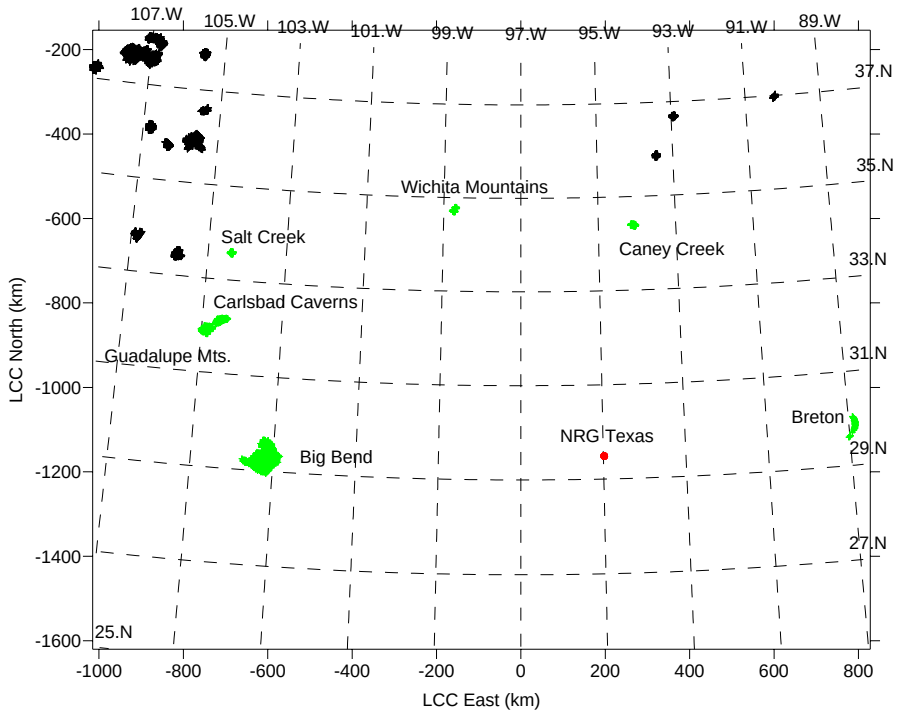

Figure 1. Source/Receptor Locations

modeled, there was no reason to run the POSTUTIL processor to incorporate nitrate and ammonia.

The only output of interest from CALPOST is visibility. Therefore, averages of PM concentration were not reported.

Since the CENRAP CALMET datasets may be considered less conservative than those adding actual meteorological values, a comparison to the 0.5 deciview threshold was performed using the maximum predicted deciview value, rather than the 98th percentile value.

Each modeled Class I area was postprocessed with CALPOST separately, since the Guidance provides specific f(RH) (Table 4 in the Guidance) and specific aerosol levels (Table 5 in the Guidance) for each Class I area. Only the receptors that correspond to each Class I area were processed with their respective Guidance values. Therefore, there were seven CALPOST runs made for each modeled year.

RESULTS & CONCLUSIONS

Results

All modeling results show that there are no exceedances of the 0.50 delta-deciview limit. All values were well below this threshold. The highest predicted delta-deciview was 0.014 which occurred on Julian day 346 (December 12th) of 2001 at receptor number 1039 (coordinates: -159.899, -584.476) in Wichita Mountains Wildlife Refuge. No other predicted delta-deciview values exceeded 0.007.

The following table shows the overall results of the modeling:

Year: 2001			
Class I Area	**Largest Delta-Deciview**	**Number of Days ≥ 0.5**	**Number of Days ≥ 1.0**
Big Bend National Park (National Park Service)	0.003	0	0
Breton Wilderness Area (Fish & Wildlife Service)	0.004	0	0
Caney Creek Wilderness Area (U.S. Forest Service)	0.003	0	0
Carlsbad Caverns National Park (National Park Service)	0.003	0	0
Guadalupe Mountains National Park (National Park Service)	0.002	0	0
Salt Creek Wildlife Refuge (Fish & Wildlife Service)	0.005	0	0
Wichita Mountains Wildlife Refuge (Fish & Wildlife Service)	0.014	0	0

Year: 2002			
Class I Area	**Largest Delta-Deciview**	**Number of Days ≥ 0.5**	**Number of Days ≥ 1.0**
Big Bend National Park (National Park Service)	0.003	0	0
Breton Wilderness Area (Fish & Wildlife Service)	0.002	0	0
Caney Creek Wilderness Area (U.S. Forest Service)	0.004	0	0
Carlsbad Caverns National Park (National Park Service)	0.002	0	0
Guadalupe Mountains National Park (National Park Service)	0.002	0	0
Salt Creek Wildlife Refuge (Fish & Wildlife Service)	0.002	0	0
Wichita Mountains Wildlife Refuge (Fish & Wildlife Service)	0.007	0	0
Year: 2003			
Class I Area	**Largest Delta-Deciview**	**Number of Days ≥ 0.5**	**Number of Days ≥ 1.0**
Big Bend National Park (National Park Service)	0.004	0	0
Breton Wilderness Area (Fish & Wildlife Service)	0.002	0	0
Caney Creek Wilderness Area (U.S. Forest Service)	0.005	0	0
Carlsbad Caverns National Park (National Park Service)	0.002	0	0
Guadalupe Mountains National Park (National Park Service)	0.002	0	0
Salt Creek Wildlife Refuge (Fish & Wildlife Service)	0.001	0	0
Wichita Mountains Wildlife Refuge (Fish & Wildlife Service)	0.003	0	0

Further detailed results can be found within the individual CALPOST output files being provided to TCEQ with this report.

Conclusions

Since the levels of maximum predicted deciview values are de minimis and well below the 0.5 deciview threshold, it can be concluded that results at any of the other Class I areas not modeled would be less than the predicted maxima.

Since this screening level modeling shows no significant visibility impacts, CDM will not perform any additional modeling with further refinements. In addition, since all maximum impacts are below the 0.5 deciview threshold, the NRG Texas P.H. Robinson Station is exempt from the remainder of the BART process. Therefore, a BART engineering analysis will not be required for this facility.

Output

A set of 3 DVDs containing all digital input and output files is included as an enclosure with this report. Due to the size of the CALMET data files, they will not be provided. It is presumed that reviewing agencies already have these files for their use.