STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division

Intraoffice Memorandum

TO: Doug Laughton, Program Manager
Permitting and Environmental Health Bureau

DATE: August 31, 2009

FROM: Jim Black, Dispersion Modeler
Permitting and Environmental Health Bureau

AFS #: 3301300026
Application #:

SUBJ: PSNH Merrimack Station – Bow
Modeling for Coal Dust

UTM E: 299011
UTM N: 4779703

Modeling Project Summary

- **Purpose:** Env-A 1400 evaluation for coal dust
- **Initial assumptions (modeling input):** see Tables 1 and 2; continuous operations
- **Pass/Fail (if failed for what):** passed for coal dust
- **Additional restrictions resulting from modeling (if failed):** none

DES has reviewed an ambient air quality impact analysis for PSNH's Merrimack Station in Bow. The analysis, as performed by TRC, was done to assess the impacts of coal dust from various operations at the facility. PSNH initially looked at the potential impacts from coal dust in 2001 in a modeling analysis performed by Northeast Utilities, and later revised their analysis in 2003. The recent TRC modeling was initially submitted in July, 2009 and later updated in August based on comments made by DES.

TRC evaluated three distinct operations which could produce airborne coal dust: railcar unloading, truck unloading and conveyor load-out. For the railcar and truck unloading operations, coal is dumped either into a partially-covered shed (in the case of the railcars) or directly on the coal pile by the trucks. In the conveyor load-out operation, coal from the railcar shed is transported to the piles by a conveyor system where it is dropped from a boom. Each operation was modeled as a volume source, and all were assumed to occur simultaneously for 8760 hrs/yr.

The modeling inputs used in the TRC analysis are shown in Table 1, while the assumptions used to develop the emission rates and to set-up the modeling are given in Table 2. The emission rates were calculated using a formula taken from AP-42 and take into account wind speed to estimate how much of the coal dust (modeled as PM10) from the various coal handling operations becomes airborne. TRC originally used the average annual wind speed to calculate emissions on both a daily and annual basis but DES requested they look at hourly emission rates when modeling against the 24-hour AAL since coal dust emissions vary over time.

Table 1
Modeled Input Data

Parameter	Units	Railcar Unloading	Trucks	Coal Load-Out
Source ID	---	Rail	Truck	Loadout
Source Type	---	Volume	Volume	Volume
Location	---	Railcar shed center	boom center	boom center
UTM E1	m	299039.3	299010.7	299010.7
UTM N1	m	4779786.6	4779703.0	4779703.0
Base Elevation	m MSL	62.8	62.8	62.8
Obstacle Height	m	10.06	15.24	15.24
Length	m	19.96	49.4	49.4
Width	m	11.89	49.4	49.4
Volume Source Height	m	5.03	0.91	4.57
Sigma-z0	m	4.68	7.09	7.09
Sigma-y0	m	4.04	12.97	12.97
Hours unloading per day	---	12	12	12
Coal handled	TPD	9000	2000	9000
Coal handled	TPH	750	167	750
Coal handled	TPY	900,000	300,000	900,000
PM10 (24-hour)	g/s	calculated hourly	calculated hourly	calculated hourly
PM10 (annual)	g/s	0.00031	0.00091	0.00315
Coal				
Moisture	%	6.42	7.08	6.42
Silt	%	2.2	2.2	2.2
Particle size mult. (k)		0.35	0.35	0.35
Mean wind speed	mph	5.42	5.42	5.42
Emission factor (E)	lb/Ton	0.000243	0.000212	0.000243
Control Efficiency	%	90	0	0
Emission factor (model)	lb/Ton	0.000024	0.000212	0.000243

Table 2
Assumptions Used in the TRC Modeling Analysis

- One train with 90 railcars will unload in 12 hours
- Each railcar unloads 100 tons of coal
- 100 trains per year will deliver coal
- 10,000 trucks per year will deliver coal
- Each truck will unload 30 tons of coal
- Up to 2000 tons of coal will be delivered in a day during a 12 hour period by truck
- The coal will drop 6 feet during truck delivery
- The coal load-out by conveyor will drop 30 feet
- The boom radius for coal load-out is 91.5 feet
- The coal pile height is 50 feet
- The moisture content of the different coals are:
  - Pile A 7.08%
  - Pile B 6.6%
  - Pile C 6.36%
  - Pile D 5.88%
- The emissions for each volume source will occur 12 hours or less per day, but since they can occur during any hour of the day, they were modeled to occur 24 hours per day. The total daily emissions for each source were equally distributed over each hour of the day.

The most recent version of AERMOD was used to predict maximum off-property impacts from the three coal handling operations. The meteorological data used in the analysis were obtained from an on-site tower and SODAR system and covered 23 months from 1994 and 1995. This is the same meteorological data set approved in 2008 by DES for the scrubber modeling project.

Table 3 presents the results of the TRC modeling analysis submitted in August, 2009, which was approved by DES. The analysis predicts all coal dust impacts to be below the AALs based on the assumptions contained in Tables 1 and 2. The maximum impacts were predicted to be on the facility property line, just to the east of the active coal pile.

For conservatism, DES modified some assumptions by way of increasing the number of tons of coal each truck can hold and the number of trucks per day. A lower coal moisture content was also examined to see what affect these changes would have on emissions and therefore on the impacts. Though the predicted coal dust impacts would increase, they are still expected to be below the AALs.

Table 3
Maximum Coal Dust Impacts (ug/m^3) from TRC Modeling
(all operations modeled at 8760 hrs/yr)

Pollutant	24-Hour Impact	24-Hour AAL	Annual Impact	Annual AAL	Pass/Fail
Coal Dust (bituminous)	2.1	4.5	0.3	3.0	PASS

Project Tracking and Details

- **Modeler(s):** J. Black **Reviewer:** L. Landry
- **Site visit made on:** 10-6-2005 by J. Black
- **Hardcopy files returned to:** D. Laughton
- **Model:** AERMOD v. 07026, AERMET v. 06341
- **Met data:** on-site data from 1994-1995 **Met site:** Bow
- **Analysis details:** an hourly emissions file was developed by TRC to account for wind speed dependent emission rates; all operations were modeled as volume sources; a minimum of one year of met data is needed according to EPA guidance but 23 months of data were collected so this period was used

Technical Memorandum

Dispersion Modeling of Fugitive Coal Dust at Merrimack Station

TRC Companies, Inc.
Lowell, Massachusetts, USA
August 2009

INTRODUCTION

In response to a request by the New Hampshire Department of Environmental Services, Air Resources Division (DES), Public Service Company of New Hampshire (PSNH) is submitting this air quality modeling report to DES as a demonstration of compliance with the regulated toxic air pollutant regulations (RSA 125-I and Env-A 1400) for coal dust for Merrimack Station. The New Hampshire Air Toxics Control Act requires facilities to demonstrate compliance with applicable Ambient Air Limits (AAL). Under Chapter Env-A 1400, coal dust is a regulated toxic air pollutant. According to Table 1450-1, the 24-hour AAL for bituminous coal dust is 4.5 $\mu g/m^3$ and the annual AAL is 3.0 $\mu g/m^3$.

Coal dust generated from coal handling operations at Merrimack Station is subject to the regulation. These operations include (1) unloading of the railcars in the railcar shed, (2) load-out of the railcar coal from the conveyor system, and (3) unloading of coal from trucks.

The air quality modeling demonstrated that coal dust emissions from Merrimack Station are in compliance with the toxic air pollutant requirements of RSA 125-I and Env-A 1400.

MODELING APPROACH

Railcar Unloading

The railcar unloading occurs in a roofed shed with openings on the sides. The fugitive coal dust from the shed will be a volume source with initial dimensions proportional to the height, width and length of the shed. Since the material is dumped from the railcar, the emission factor was calculated from section 13.2.4 of AP-42 which provides estimates for aggregate handling. The relationship is,

$$E = 0.0032\ (k)\ (U/5)^{1.3}/(M/2)^{1.4} \qquad \text{Equation (1)}$$

where,
E is the emission factor in pounds of particulate per ton of material handled,
k = 0.35 for PM_{10},
U is the mean wind speed at the site in mph, and
M is the moisture content of the coal in percent.

For the annual emission rate, U was calculated as the mean wind speed over the 23 months of onsite wind speed data at the 10m level of the meteorological tower. The mean wind speed was 5.42 mph. The moisture content varies with the origin of the coal.

For the 24-hour averaged concentrations, the emission rate will change hourly with the wind speed. For each hour of the year the wind speed from the 10-meter level of the meteorological tower was input into equation (1) and an hourly emission factor was calculated. These factors were then used to calculate hourly emission rates that were input to AERMOD using the HOUREMIS keyword.

Since the unloading process is enclosed within the shed plus a wet suppression system is used during railcar unloading, the control efficiency was estimated at 90%.

Conveyor Load-out

After the coal is unloaded from the railcar, it is taken by conveyor to a boom that drops the coal to the appropriate pile. Since the material is dropped, this was also modeled as a volume source. The boom radius and height of the surrounding coal piles were used to calculate the initial dimensions of the volume source. The height of the volume source was estimated as half the drop height. Equation (1) was also used to estimate the emissions released for the annual and hourly emission rates. Hourly emissions for the conveyor load-out were input to AERMOD through HOUREMIS.

Truck Unloading

Coal is also delivered by truck and unloaded in the coal pile area near the conveyor load-out system. This material is also dropped and was modeled as a volume source. The height of the surrounding coal piles and the area where the coal is delivered were used to estimate the initial dimensions of the volume source. The height of the volume source was estimated as half the drop height. Equation (1) was used to estimate the emissions released for both annual and hourly emission rates. Hourly emissions for the truck unloading were input to AERMOD through HOUREMIS.

From Table 13.2.4-1 of AP-42, a mean value of the silt percentage of coal received at coal-fired power plants was measured from 60 samples as 2.2%. This value has been adopted for this modeling analysis.

MODELING DATA

The meteorological and model receptor data were obtained from the recent air modeling study for the Clean Air Project at Merrimack Station. The meteorological data were from the meteorological tower and SODAR system located at the site. These data covered the 23-month period from January 1994 through November 1995. These data were processed using the AERMET preprocessor program to prepare the meteorological data for AERMOD. The 557 provided by DES on July 31, 2009 were used to predict coal dust concentrations at the property boundary and nearby locations. Plots of the receptors and the fugitive coal dust sources are shown in Figures 1 and 2.

The emissions calculations for the volume sources are presented in Table 1. The primary assumptions are:

- One train with 90 railcars will unload in 12 hours
- Each railcar unloads 100 tons of coal
- 100 trains per year will deliver coal
- 10,000 trucks per year will deliver coal
- Each truck will unload 30 tons of coal
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- The emissions for each volume source will occur 12 hours or less per day, but since they can occur during any hour of the day, they were modeled to occur 24 hours per day. The total daily emissions for each source were equally distributed over each hour of the day.

The hourly emissions for the 3 volume sources that were input to AERMOD through the HOUREMIS keyword are provided along with the other modeling input and output files.

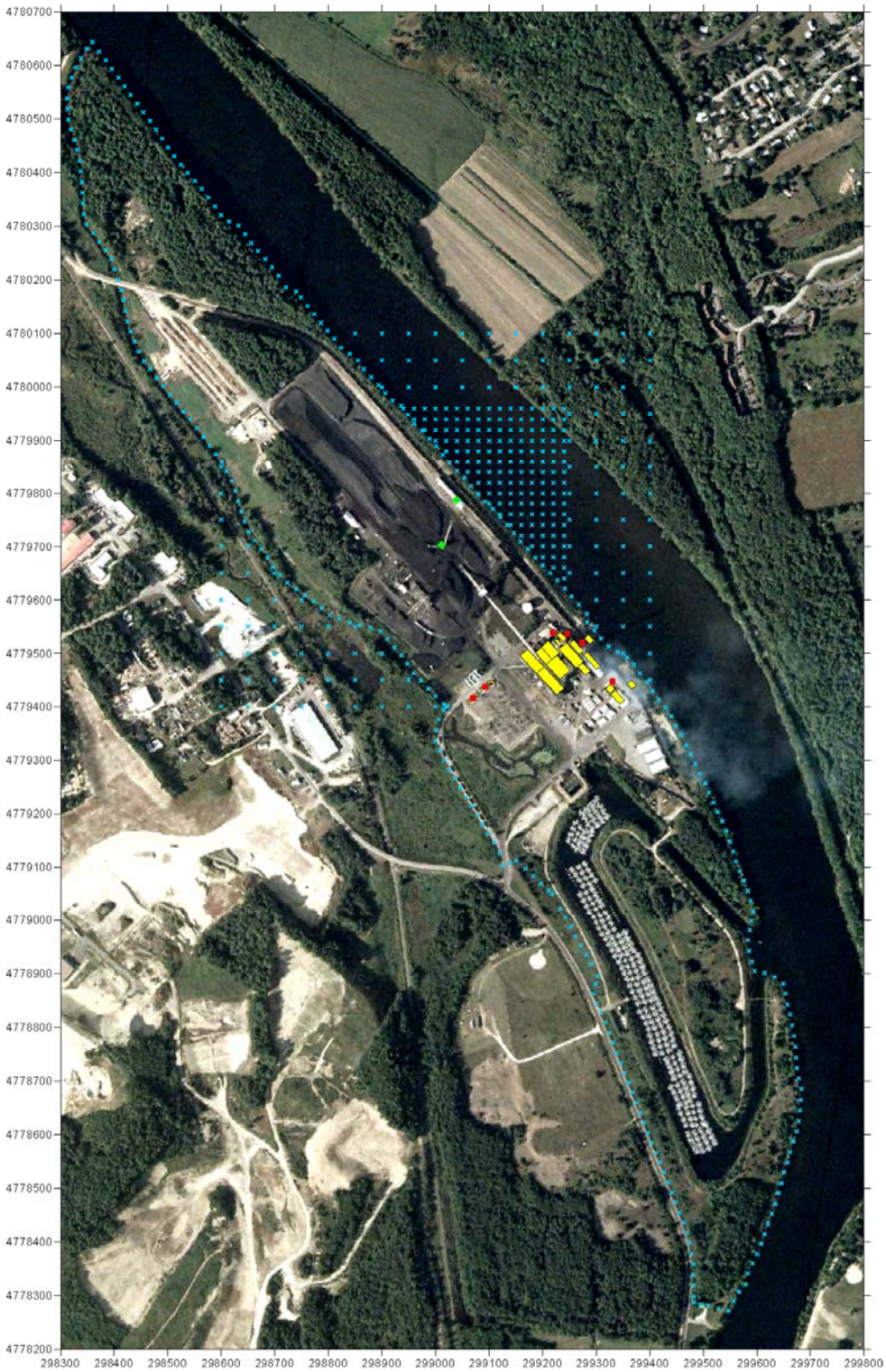

Figure 1 Fugitive coal dust source locations (shown as green squares) and fenceline and other nearby receptors specified by DES. The plant combustion sources and buildings are noted for reference.

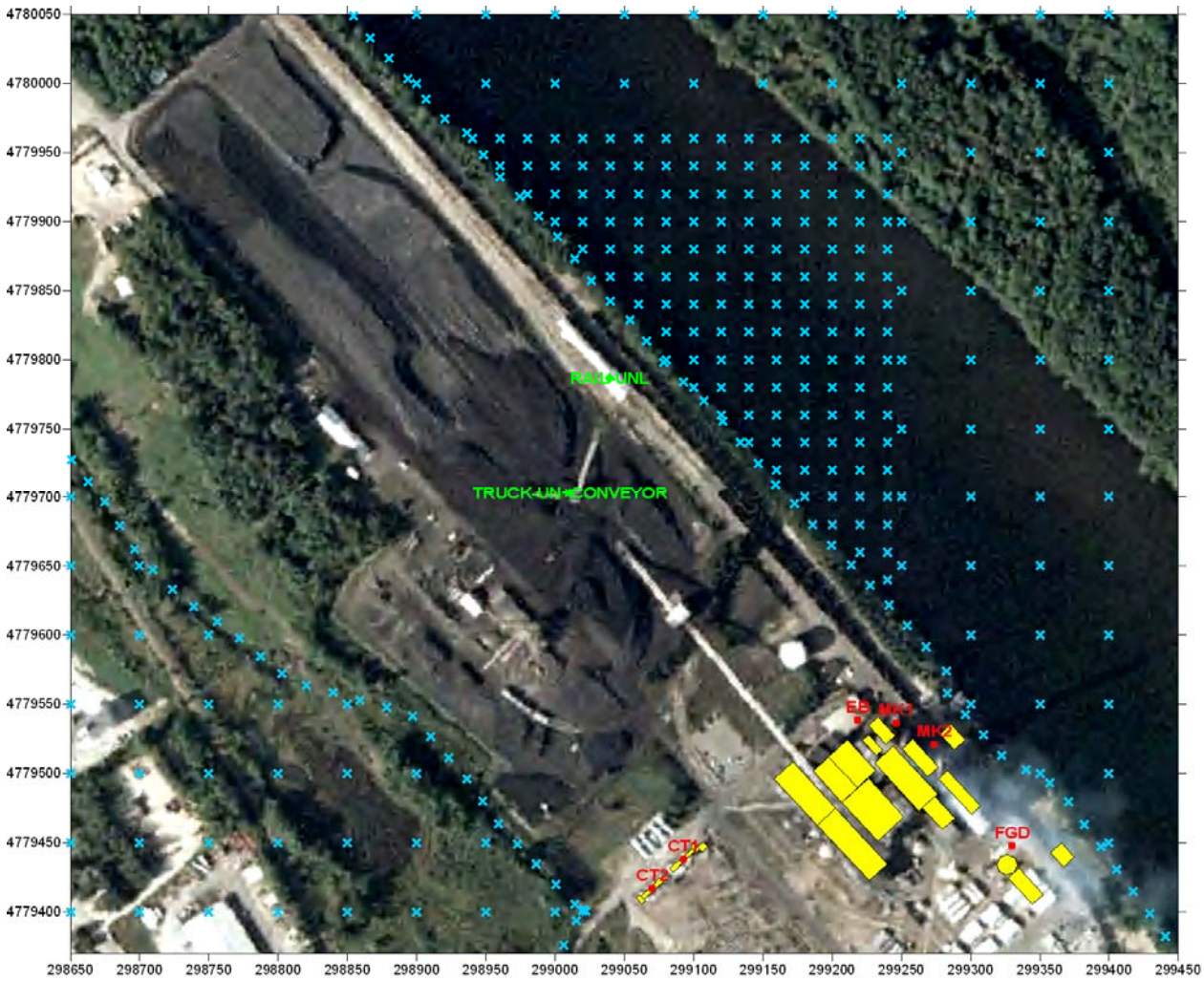

Figure 2 Fugitive coal dust source locations and fenceline and other nearby receptors specified by DES receptors (zoomed view). The plant combustion sources and buildings are noted for reference.

Table 1: Emission Calculations for Fugitive Coal Dust Sources

Parameter	Units	Railcar Unloading	Trucks	Coal Load-Out
Source ID	---	Rail	Truck	Loadout
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MODELING RESULTS

The AERMOD model (version 07026) was used to model the volume sources. The maximum 24-hour averaged coal dust concentration was predicted to be 1.9 $\mu g/m^3$ during 1994 and 2.1 $\mu g/m^3$ during 1995. These concentrations are below the 24-hour AAL of 4.5 $\mu g/m^3$.

The maximum annual averaged coal dust concentration was predicted to be 0.3 $\mu g/m^3$ in 1994 and 0.3 $\mu g/m^3$ in 1995. These modeled concentrations of coal dust are below the annual AAL of 3.0 $\mu g/m^3$.

Therefore, coal dust emissions at Merrimack Station are in compliance with the requirements of RSA 125-I and Env-A 1400.