

Attachment B

Memorandum on Air Quality Modeling on Knowlton Township, Warren County of New Jersey by the New Jersey Department of Environmental Protection and the Resulting Maps and Graphs

December 18, 2007



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

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Governor

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Commissioner

MEMORANDUM

TO: Sandy Krietzman, Chief
Bureau of Air Quality Planning

FROM: ^{A.D.} Alan Drësser and ^{R.H.} Robert Huizer
Bureau of Air Quality Evaluation

DATE: December 6, 2007

SUBJECT: Portland Generating Station Modeling in Support of the Warren
County PM-2.5 Redesignation Analysis

This memo summarizes the procedures and results to date of the Bureau of Technical Services' (BTS) PM-2.5 modeling analysis of the Portland Generating Station. The impact of primary PM-2.5 emissions and secondary PM-2.5 particulate formed from sulfur dioxide and nitrogen oxides emissions (sulfate and nitrate, respectively) were modeled with the non-steady state dispersion model Calpuff. Below is a brief description of the modeling and a summary of the results.

Modeling Platform

Modeling of the Portland Generating Plant was performed with the latest EPA approved version of the CALPUFF modeling suite, CALMET/CALPUFF Version 5.8 Level 07063, CALPOST Version 5.6394 Level 070622.

Meteorology

One year of meteorological data (2002) was used in the modeling. The following meteorological data sets were input into CALMET to generate the windfields for modeling:

1. The 2002 12km grid spacing Mesoscale Model Version 5 (MM5) prognostic data obtained from the Ozone Transport Commission (OTC). This data set was previously used in the 8-hour ozone CMAQ modeling conducted for the OTC states' ozone SIPs and is currently being used for the annual PM-2.5 SIP modeling in the Northeast U.S.
2. 10 nearby NWS ASOS hourly surface stations data

3. Albany NY, Brookhaven NY, and Dulles VA NWS upper air stations twice daily observations data.

4. 3 NOAA hourly buoy data (located off the coasts of Long Island NY, New Jersey, and Virginia).

Geophysical Data / Background Data

Geophysical data used included USGS 30 meter digital elevation model (DEM) data and USGS Land use Land coverage files. 2002 hourly ozone data was obtained from VISTAS.

Computational Grid Size and Receptor Grids

The near-field modeling analysis has been revised. The revised near-field grid used a 250 meter cell size with 200 rows and 200 columns and 12 vertical layers. A Cartesian grid with 10,000 receptors with 100 meter spacing was used.

Emission Rates

Units 1 and 2 Sulfur Dioxide – Based on allowable 3-hour emission limits;

Unit 1 = 5820 lb/hr

Unit 2 = 8900 lb/hr

Units 1 and 2 Nitrogen Oxides – Unit 1 based on lbs/MMBtu concentration limit and heat input of 1657.2 MMBtu/hr, Unit 2 based on 30-day limit of 379.4 tons/month;

Unit 1 = 613.2 lb/hr

Unit 2 = 1053.9 lb/hr

Units 1 and 2 Direct PM-2.5 – The emission rates were calculated based on heat inputs of 1657.2 MMBtu/hr for Unit 1 and 2511.6 MMBtu/hr for Unit 2:

Direct PM-2.5 condensable emissions are based on a stack test conducted by Alstom during normal operations on Unit 1 on June 13, 2006. A report on this stack test is available at:

www.netl.doe.gov/.../coalpower/ewr/mercury/control-tech/pubs/42306/ALSTOM-Hg-DOE%20Qtrly%20Sep%202006.pdf

This value was increased to reflect the maximum sulfur content of coal Portland could fire and still meet their sulfur dioxide emission limit. Direct PM-2.5 filterable emissions are based the unit's allowable total particulate emission rate and AP-42 particle size ratio of PM-2.5 to total particulate (0.29). These emission factors are applied to both units.

filterable PM-2.5 emissions = 0.1 lbs/MMBtu (permit limit for total particulate) x 0.29 (AP-42, Table 1.1-6, ESP) = 0.029 lb/MMBtu
condensible PM-2.5 - Increase condensible portion measured in Alstom stack test (0.030 lbs/MMBtu) by ratio of maximum sulfur content of coal to the sulfur content of coal in stack test (2.4 % / 1.95 %) = 0.037 lbs/MMBtu

Total PM-2.5 = 0.066 lbs/MMBtu
Unit 1 = 109.4, Unit 2 = 165.8 lbs/hr.

Other PM-2.5 Sources at Portland

In addition to Units 1 and 2, there will be PM-2.5 emissions from Unit 5 (150 MW simple-cycle turbine) and from coal handling operations. Though much lower in magnitude than emissions Unit 1 and 2, they never-the-less need to be included when calculating the total PM-2.5 impact from the Portland Power Plant. This will be done in the future. The results contained in this memo do not include the contribution from Unit 5 and fugitive emissions.

Background PM-2.5 Concentrations

Background concentrations were taken from two existing PM-2.5 monitors. One was the PADEP monitor located in Freemansburg, PA, approximately 23 miles southwest of the Portland Station. This monitor accurately represents PM-2.5 background levels being advected into the Portland area when winds are from the southwest quadrant. The meteorological conditions of concern are light to moderate winds from the southwest quadrant. Because the Freemansburg monitor is located near an urbanized area, an additional monitor was selected that was more representative of a rural location. The other monitor used was NJDEP's monitor located in Chester, NJ, approximately 21 miles east-southeast of the Portland Stations. PM-2.5 measurements taken by this monitor are among the lowest in New Jersey.

The days in July impacted by the large forest fires in Quebec Canada were not included as background. Table 1 below lists the 98th percentile 24-hour and annual PM-2.5 background based on the average daily values of the two monitors. Because measurements are taken only once every three days at the Chester monitor, daily values between measurements were interpolated based on trends at the Freemansburg monitor and meteorological conditions. When no data was reported on a monitoring day at Chester, the measurement taken at the Morristown NJ monitor was substituted. There was no substitution for missing data from Freemansburg. On those days only the Chester monitoring data was used. In the future, data collected at the Allenstown PM-2.5 monitor may be used as a substitution for missing Freemansburg data.

Table 1. 2002 PM-2.5 Monitored Concentrations

Averaging Time	Chester, NJ ($\mu\text{g}/\text{m}^3$)	Freemansburg, PA ($\mu\text{g}/\text{m}^3$)	Average ($\mu\text{g}/\text{m}^3$)
98 th Percentile 24-hour	30	41	33.3
Annual	10.5	14.1	12.3

Results

Table 2 below lists the results for receptors located in New Jersey. The table lists the maximum 24-hour and annual PM 2.5 impacts. In addition, the 8th high 24-hour is listed. The modeling results for the near field simulations predict a maximum 24-hour impact of $21.2 \mu\text{g}/\text{m}^3$. The maximum 8th highest impact was $7.8 \mu\text{g}/\text{m}^3$. Note the current 24-hour National Ambient Air Quality Standard (NAAQS) is $35 \mu\text{g}/\text{m}^3$. The revised modeling results listed in the table include the conversion of sulfate to ammonium sulfate and nitrate to ammonium nitrate. Table 2 shows that the addition of the Portland Power Plant's contribution to background PM_{2.5} concentrations exceeds the 24-hour PM_{2.5} NAAQS.

Table 2. Maximum Predicted Calpuff PM_{2.5} Concentrations^(a)

Averaging time	Maximum Impact ($\mu\text{g}/\text{m}^3$)	Background ($\mu\text{g}/\text{m}^3$)	Total Impact ($\mu\text{g}/\text{m}^3$)
Annual	0.78	11.8	12.6
Maximum 24-hour	21.2	--	--
98 th Percentile 24-hour	7.2	33.3	40.5

a. The PM_{2.5} Annual National Ambient Air Quality Standard (NAAQS) is $15 \mu\text{g}/\text{m}^3$ and the 24-hour NAAQS is $35 \mu\text{g}/\text{m}^3$.

In addition to adding the maximum impact to monitored background data, each modeled peak daily PM-2.5 impact was compared to that days monitored daily background data to see if any new violations of the 24-hour PM-2.5 had occurred. The results of this analysis showed that there were 11 days in 2002 where the total exceeded $35 \mu\text{g}/\text{m}^3$. Of those eleven days, seven are caused by background data alone, and four days are new violations.

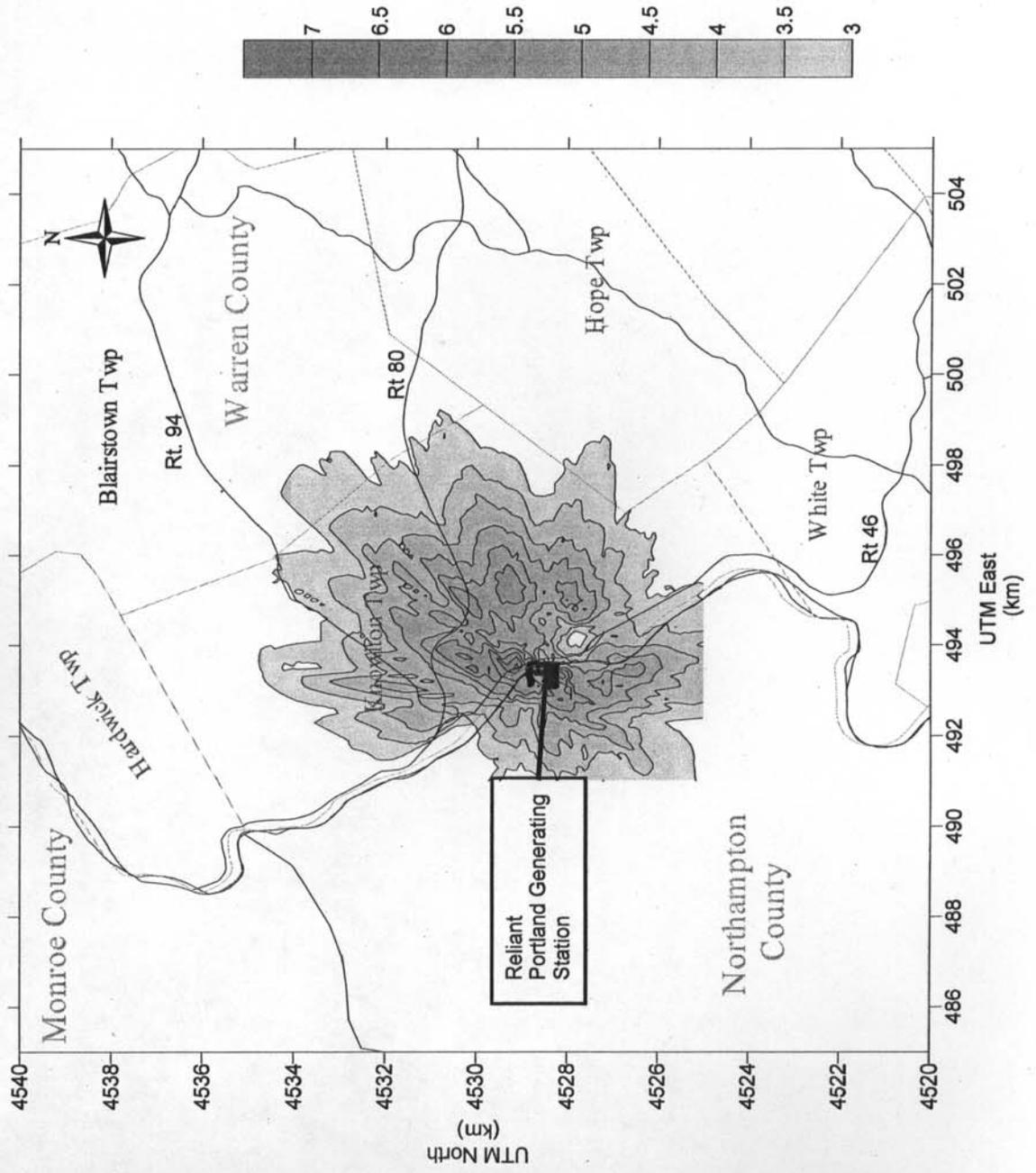
Table 3 lists the three options for the 24-hour Class II PM_{2.5} significant impact levels proposed by EPA in their September 21, 2007 FR notice "Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers (PM_{2.5}) – Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentrations (SMC)." Portland Generating Station had a significant impact on each of the eleven days if a significant impact level of $1.2 \mu\text{g}/\text{m}^3$ is used.

Table 3. EPA's Proposed 24-hour Class II PM_{2.5} Significant Impact Levels

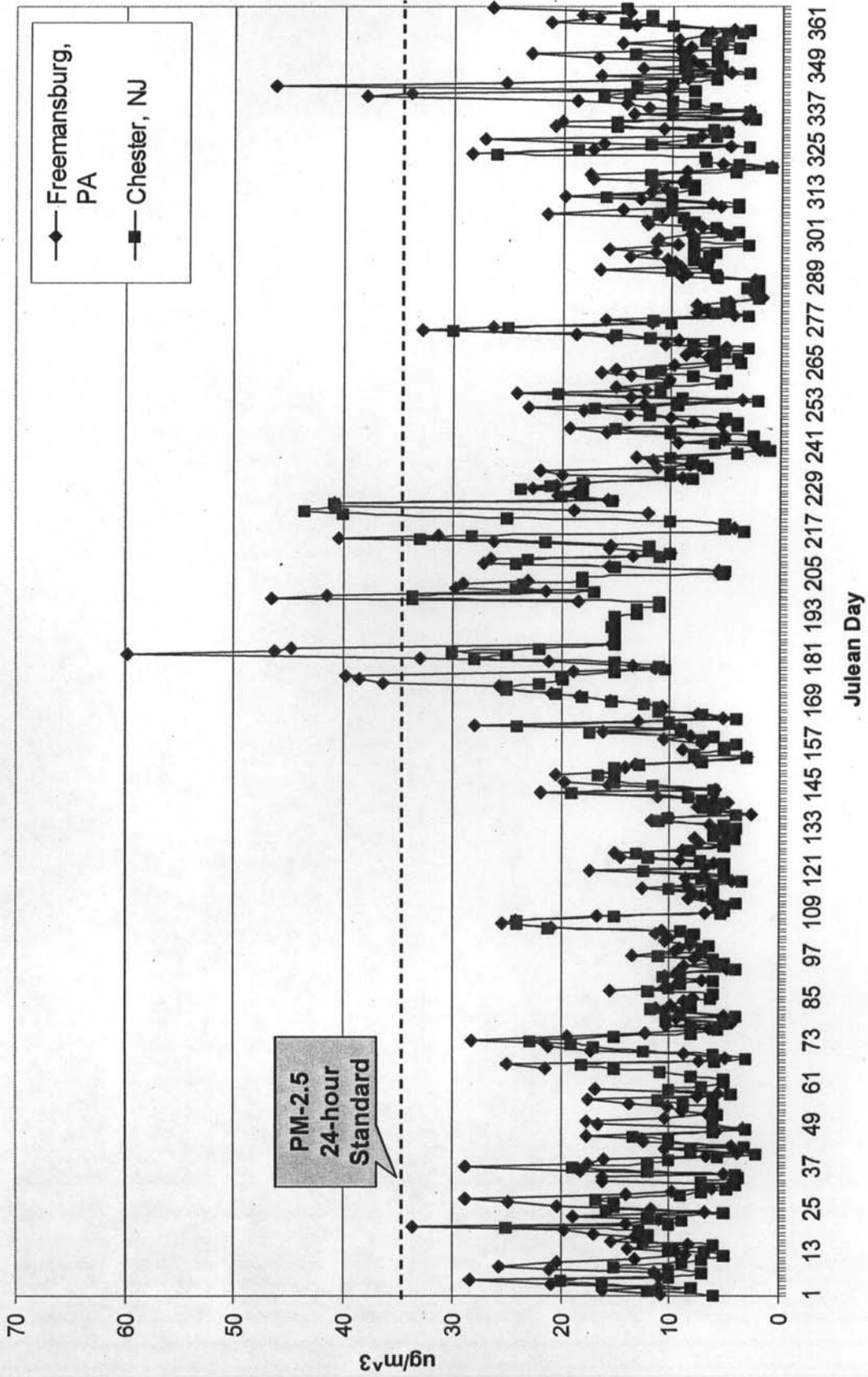
Averaging Time	Option #1	Option #2	Option #3
24-hours	5.0 ug/m ³	4.0 ug/m ³	1.2 ug/m ³

c: John Jenks (BTS)
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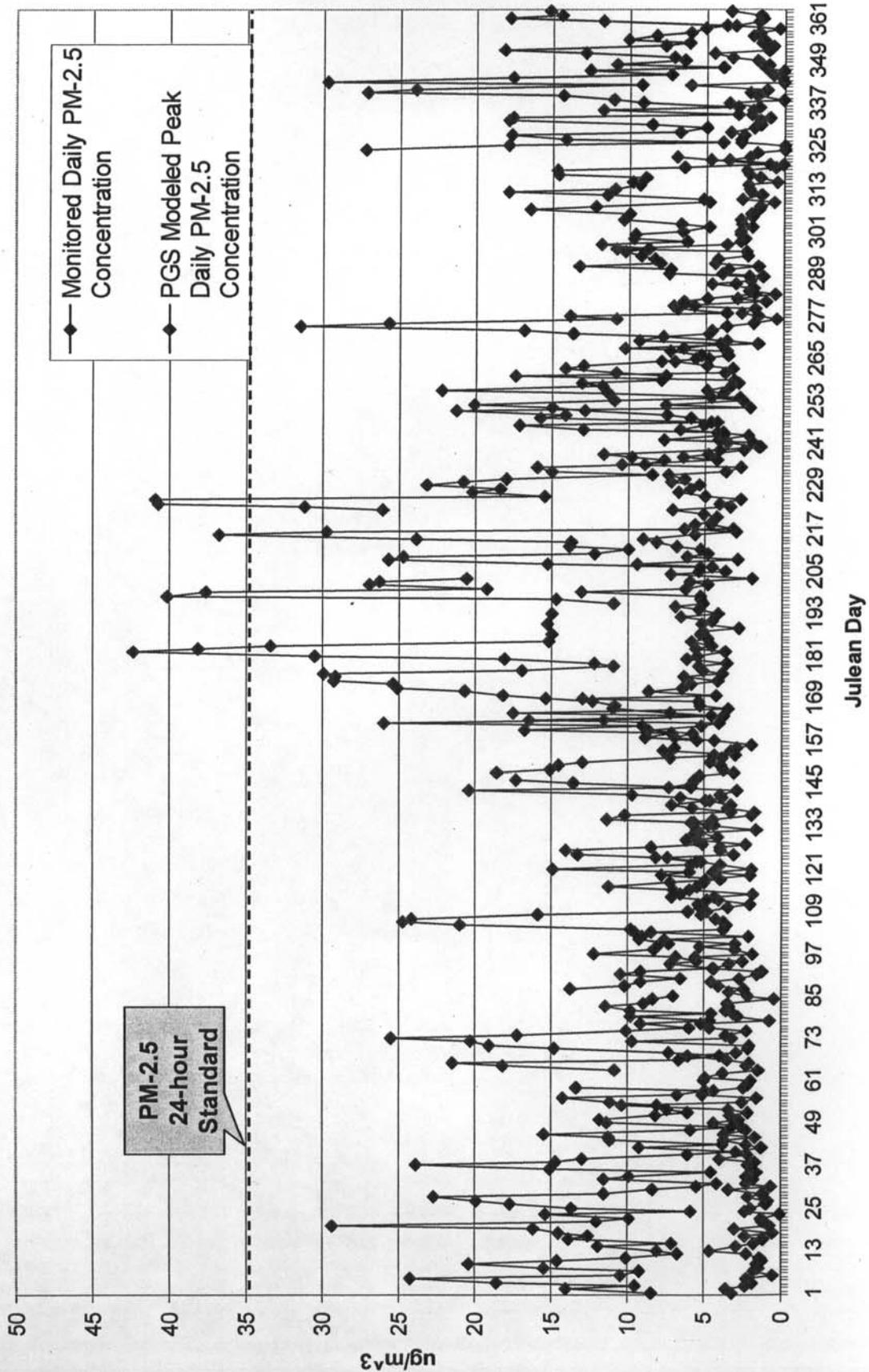
Portland Generating Station's Maximum 8th High 24-hour PM-2.5 Impacts



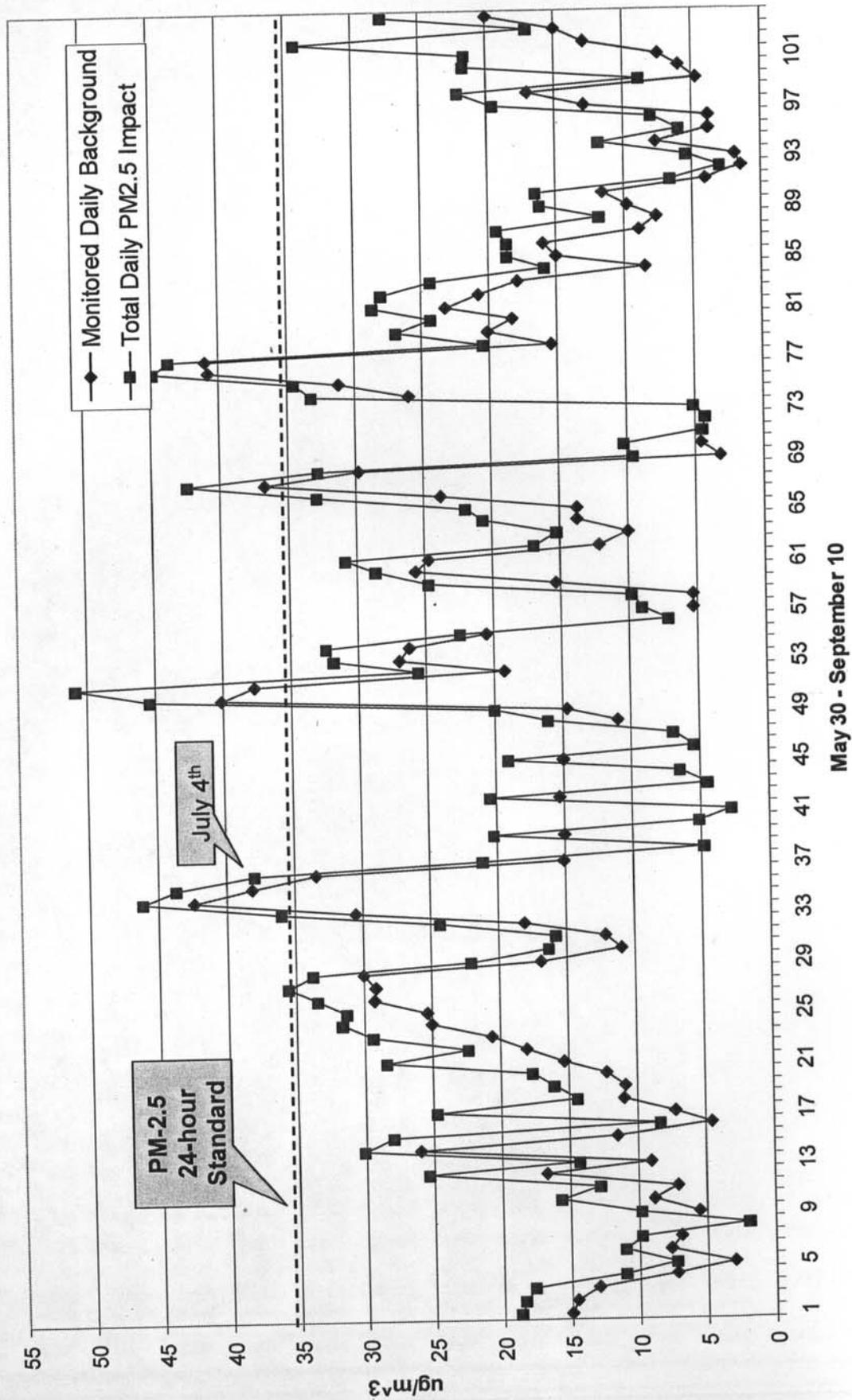
2002 Daily PM2.5 Monitored Values



Portland Generating Station Modeled Daily PM-2.5 Impacts vs. Monitored Background Data For 2002

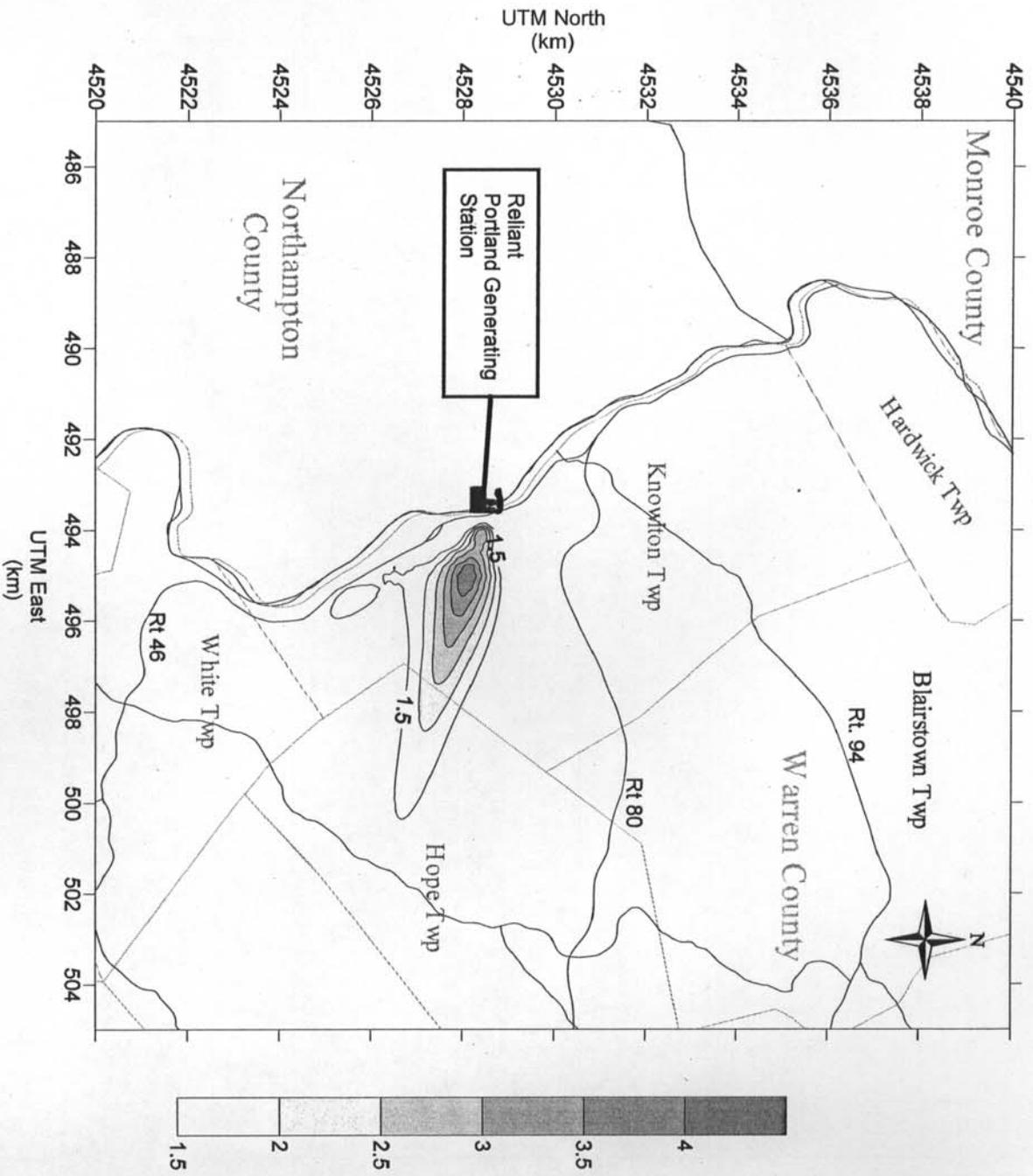


Portland Generating Station Modeled Daily PM-2.5 With Added Background, Summer 2002



May 30 - September 10

Portland Generating Station's 24-hour PM-2.5 Impacts on July 4th 2002



Impacts Above the 24-hour PM-2.5 Air Quality Standard on July 4th 2002 Portland Generating Station's Impacts added to Background (33.3 ug/m³)

