State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JON S. CORZINE
Governor

LISA P. JACKSON
Commissioner

Environmental Regulation
P.O. Box 423
Trenton, NJ 08625-0423

MEMORANDUM

TO: Sandy Krietzman, Manager

FROM: Ray Papalski, Supervisor

SUBJECT: 1 versus 9 cell differences in the Relative Reduction Factors

DATE: January 17, 2008

This memorandum documents the analysis of the spatial variations of the component species of fine particulate matter within the New Jersey grid cells modeled as part of the Ozone Transport Commission Attainment modeling demonstration.[1] The USEPA modeling guidance suggests a spatial analysis be performed to determine if "strong spatial gradients" exist. If strong spatial gradients exist, the USEPA guidance requires the use of the single value in the grid cell containing the monitor rather than the spatially averaged values of the nearby predictions (mean value of the grid cell array).[2] To perform this exercise, Relative Response Factors (RRF's) were calculated for each component species in each individual grid cell containing a monitor and were calculated using an average of the nine-grid cell array surrounding each monitoring site. Calculation of the RRF involves using the monitoring results from the 2002 base year modeling and 2009 future year modeling and this calculation is discussed in Appendix C of the New Jersey attainment demonstration for fine particulate matter.

Table 1 below presents the average annual RRF, calculated using the daily RRF's from the modeling, for the single grid cell containing the monitor and for the nine-cell average of the RRF's for each monitoring location in the State. These statewide RRF's were calculated by averaging the RRF's at the single Grid cells containing the monitor and averaging the RRF's from the nine-grid cell array average. As can be seen from this table, no significant differences exist between the RRF's obtained from the single grid cell and the RRF's obtained from the nine-cell average RRF for all component species.

[1] See the New Jersey 2007 8-hour Ozone NAAQS Attainment Demonstration and the 2008 annual fine particulate NAAQS Weight-of-evidence determination.
[2] "Guidance on the use of models and other analyses for demonstrating attainment of air quality goals for ozne, PM2.5, and regional haze", USEPA, April 2007, EPA-454/B-07-002, page 28 and 29.

Table 1: Statewide Average of the RRF's for Each Modeled Component Species of Fine Particulate Matter Using the Average of the Annual RRF Obtained from the Single Grid Cell Containing the Monitor and from the Nine-Cell Average RRF's.

	Sulfates	Nitrates	Elemental Carbon	Ammonium	Directly Emitted Particles	Organics (PA)	AORGA	AORGB
One Cell where monitor located	0.77	0.86	0.78	0.83	1.12	0.96	0.94	1.01
Nine-Cell Average	0.77	0.87	0.79	0.84	1.12	0.97	0.94	1.01

Each monitoring site was also analyzed to compare the RRF at the monitoring location and the nine-cell average to ensure that all sites did not have large spatial gradients that were not detected by the previous calculation. The ratio of the RRF for each component species using the single cell RRF to the nine-cell average RRF was determined and is attached as Table 2.

As can be seen from this table, the maximum ratio of the single grid cell to the nine-cell average was 1.02 for sulfates and elemental carbon meaning that using the RRF from the grid cell from the single monitor may result in a slightly higher prediction of sulfate or elemental carbon levels in future years. For example, if the sulfate RRF from a single cell is 0.785 and the sulfate RRF from the nine-cell average is 0.772 (resulting in a 1.02 ratio), multiplication to a sulfate design value of 4 ug/m3, for example, would give a future year predicted level of 3.14 ug/m3 using the single cell versus a future year predicted level of 3.09 ug/m3 using the nine-cell average. The minimum ratio of the single grid cell to nine-cell average was 0.91 for elemental carbon at some sites. Use of the single grid cell RRF would, therefore, lead to a lower prediction of the future values than the nine-cell average. For example, if the elemental carbon RRF from a single cell is 0.702 and the elemental carbon RRF from the nine-cell average is 0.769 (resulting in a 0.91 ratio), multiplication to a elemental carbon design value of 2 ug/m3, for example, would give a future year predicted level of 1.40 ug/m3 using the single cell versus a future year predicted level of 1.54 ug/m3 using the nine-cell average.

Conclusion:

As large spatial variations do not exist in all sites and as use of the nine-cell average is a more conservative method of calculating future year values, it is recommended that the nine-cell average array RRF's be used to estimate future year fine particulate levels over New Jersey.

c: Christine Schell

Table 2: Ratio of Single Cell RRF to Nine-Cell Average RRF for each Component Species

Monitor ID	County	Latitude	Longitude	Sulfate	Nitrate	Elemental Carbon	Ammonium	Directly Emitted Particles	Organics (PA)	AORGA	AORGB
3400110061	Atlantic	39.3633	-74.4298	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.00
3400300031	Bergen	40.8517	-73.9733	0.96	0.99	0.98	0.97	1.00	1.00	1.00	1.00
3400700031	Camden	39.9228	-75.0972	1.02	0.98	0.99	1.00	1.00	0.99	1.00	1.00
3400700032		39.9228	-75.0972	1.02	0.98	0.99	1.00	1.00	0.99	1.00	1.00
3400700035		39.9228	-75.0972	1.02	0.98	0.99	1.00	1.00	0.99	1.00	1.00
3400710071		39.9883	-75.0497	0.98	0.98	0.95	0.97	0.96	0.99	1.00	1.00
3401300151	Essex	40.7319	-74.2053	0.98	0.97	0.91	0.97	1.00	0.98	1.00	1.00
3401300161		40.7222	-74.1469	0.98	0.97	0.91	0.97	1.00	0.98	1.00	1.00
3401300162		40.7222	-74.1469	0.98	0.97	0.91	0.97	1.00	0.98	1.00	1.00
3401550011	Gloucester	39.8272	-75.2892	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00
3401710031	Hudson	40.7261	-74.0533	1.02	1.00	1.02	1.01	0.99	0.99	1.00	1.00
3401710032		40.7261	-74.0533	1.02	1.00	1.02	1.01	0.99	0.99	1.00	1.00
3401720021		40.7731	-74.0319	1.01	1.00	0.99	1.00	1.00	1.00	1.00	1.00
3402100081	Mercer	40.2222	-74.7636	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3402180011		40.315	-74.8547	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3402300061	Middlesex	40.4733	-74.4256	1.00	1.00	0.99	1.00	1.01	1.00	1.00	1.00
3402300065		40.4733	-74.4256	1.00	1.00	0.99	1.00	1.01	1.00	1.00	1.00
3402300066		40.4733	-74.4256	1.00	1.00	0.99	1.00	1.01	1.00	1.00	1.00
3402700041	Morris	40.8031	-74.4833	1.00	1.02	1.02	1.01	1.02	1.01	1.00	1.00
3402730011		40.7872	-74.6775	1.00	1.02	1.01	1.01	1.02	1.01	1.00	1.00
3402730015		40.7872	-74.6775	1.00	1.02	1.01	1.01	1.02	1.01	1.00	1.00
3402920021	Ocean	39.995	-74.1658	1.00	0.99	1.00	1.00	1.00	1.01	1.00	1.00
3403100051	Passaic	40.9186	-74.1678	0.99	0.97	0.99	0.98	1.00	1.00	1.00	1.00
3403900041	Union	40.6411	-74.2078	0.99	0.98	1.02	0.98	0.99	1.01	1.01	1.00
3403900042		40.6411	-74.2078	0.99	0.98	1.02	0.98	0.99	1.01	1.01	1.00
3403900045		40.6411	-74.2078	0.99	0.98	1.02	0.98	0.99	1.01	1.01	1.00
3403900061		40.6731	-74.2136	0.98	0.97	0.91	0.97	1.00	0.98	1.00	1.00
3403920031		40.6081	-74.275	0.99	0.98	1.02	0.98	0.99	1.01	1.01	1.00
3404100061	Warren	40.6872	-75.1814	1.01	0.98	1.00	0.99	0.99	0.99	1.00	1.00