STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

Rhode Island 2012 Annual Monitoring Network Plan

Posted for Public Review on June 25, 2012

Submitted to the EPA on August 1, 2012

Regulatory Background

Section 58.10(a) of Title 40 of the Code of Federal Regulations (40 CFR 58.10(a)) requires states to submit a monitoring network plan to the United States Environmental Protection Agency (EPA) in July of each year. The plan must provide a description of the state's current monitoring network, demonstrate that the network conforms to EPA requirements, and discuss any plans to remove or move a monitoring station in the 18 months following the plan submittal. The plan must be posted for public comment 30 days prior to submittal to the EPA. This document will serve as Rhode Island's 2012 annual Monitoring Network Plan.

Rhode Island Monitoring Network

The Rhode Island Department of Environmental Management (RI DEM), in conjunction with the Rhode Island Department of Health (RI DOH), operates a network of air monitoring stations to measure ambient concentrations of pollutants for which the EPA has established a National Ambient Air Quality Standard (NAAQS). Those pollutants, which are known as criteria pollutants, include ozone (O_3), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO) and lead. The criteria pollutant monitoring sites are part of the EPA's State or Local Air Monitoring Stations network (SLAMS).

In addition, RI DEM and RI DOH monitor ambient levels of toxic air pollutants and of ozone precursors, which are substances that react in the atmosphere to form ground-level ozone. The State operates one monitoring site that is part of the National Air Toxics Trends Sites (NATTS) network, two that are part of the Photochemical Assessment Monitoring Stations (PAMS) network, one that is part of the $PM_{2.5}$ Speciation Trends Network (STN) and one that is part of the network of core multipollutant monitoring stations (NCore).

Table 1 summarizes the NAAQS and Table 2 lists the locations of the eight air monitoring stations currently operating in the State, along with the parameters monitored and monitoring methods used at each of the sites. The locations of those sites are shown in Figures 1-4. All of these sites have been approved by EPA Region I as meeting applicable siting criteria, as specified in Subpart B of 40 CFR Part 58. All criteria pollutants are monitored, as required in the CFR, using Federal Reference Methods (FRMs) or Federal Equivalent Methods (FEMs) and monitors are operated according to the procedures specified in Quality Assurance Project Plans (QAPPs) that have been approved by EPA.[1] All sites are located in the Providence-Fall River-Warwick, RI-MA Metropolitan Statistical Area (MSA), which encompasses all of Rhode Island as well as Bristol County in Massachusetts.

[1] RI DEM and RI DOH, "QAPP for Criteria Pollutants Including Particulates, Revision 9.4," approved by EPA December 11, 2006 and "QAPP: Air Toxics and PAMS Monitoring Programs, Revision 3.1," approved by EPA September 27, 2006.

Table 1 National Ambient Air Quality Standards (NAAQS)

POLLUTANT	AVERAGING TIME	PRIMARY STANDARD	SECONDARY STANDARD
Sulfur Dioxide (SO_2)	3-Hour[A]	None	0.5 ppm (1300 μg/m³)
	1-Hour[B]	0.075 ppm (75 ppb)	None
Carbon Monoxide (CO)	8-Hour[A]	9 ppm (10 mg/m³)	None
	1-Hour[A]	35 ppm (40 mg/m³)	None
Ozone (O_3)	8-Hour[C]	0.075 ppm (75 ppb, 157 μg/m³)	Same as Primary Standard
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.053 ppm (53 ppb, 100 μg/m³)	Same as Primary Standard
	1-Hour[D]	100 ppb	None
Particulate Matter ≤10 micrometers (PM_{10})	24-Hour[E]	150 μg/m³	Same as Primary Standard
Particulate Matter ≤ 2.5 micrometers ($PM_{2.5}$)	Annual Arithmetic Mean[F]	15.0 μg/m³	Same as Primary Standard
	24-Hour[G]	35 μg/m³	Same as Primary Standard
Lead (Pb)	Rolling 3-Month Average[H]	0.15 μg/m³	Same as Primary Standard

Primary standards protect against adverse health effects. **Secondary standards** protect against welfare effects such as damage to crops, vegetation, and buildings.

[A]Not be exceeded more than once a year.

[B] A rule revoking the annual and 24-hour SO_2 NAAQS and promulgating a new 1-hour SO_2 NAAQS was signed on June 2, 2010. To attain the 1-hour NAAQS, the 3-year average of the 99th percentile of the daily maximum 1-hour average SO_2 level at each monitor must not exceed 75 ppb.

[C] The ozone NAAQS is violated when the average of the 4th highest daily eight-hour concentration measured in 3 consecutive years exceeds 0.075 ppm (75 ppb). The 0.075 ppm NAAQS became effective in May 2008.

[D] To attain the 1-hour NO_2 NAAQS, effective January 22, 2010, the 3-year average of the 98th percentile of the daily maximum 1-hour average NO_2 concentration at each monitor must not exceed 100 ppb.

[E] To attain the PM_{10} standard, the 24-hour concentration at each site must not exceed 150 μg/m³ more than once per year, on average over 3 years.

[F] To attain the $PM_{2.5}$ annual standard, the 3-year average of the weighted annual means of the 24-hour concentrations, must not exceed 15 μg/m^3.

[G] To attain the $PM_{2.5}$ 24-hour standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-based monitor must not exceed 35 $\mu g/m^3$.

[H]On October 15, 2008, the Pb NAAQS was changed to 0.15 $\mu g/m^3$ as a rolling 3-month average, not to be exceeded in a 3-year period.

$\mu g/m^3$ = micrograms per cubic meter
mg/m^3 = milligrams per cubic meter
ppb = parts per billion
ppm = parts per million

Table 2: Monitoring Sites

Site	AQS ID	Latitude Longitude	Parameter Measured	Method Of Sampling	EPA Method Designation
Vernon Trailer Vernon Street Pawtucket	440070026	41.874675 -71.379953	$PM_{2.5}$	Lo Vol	Reference
			PM_{10}	Hi Vol	Reference
			VOC	Canisters, GC/FID/MS	Reference
Johnson & Wales 111 Dorrance Street Providence	440070027	41.822686 -71.411089	PM_{10}	Hi Vol	Reference
Hallmark Building 695 Eddy Street Providence	440070028	41.80933 -71.40743	$PM_{2.5}$	Lo Vol	Reference
Brown University 10 Prospect Street Providence	440070012	41.825556 -71.405278	Oxides of Nitrogen	Chemiluminescence	Reference
			Nitrogen Dioxide	Chemiluminescence	Reference
			Sulfur Dioxide	Simulated Fluorescence	Equivalent
USEPA Laboratory 27 Tarzwell Drive Narragansett	440090007	41.4950779 -71.4236587	Ozone	U.V. Photometric	Reference
			$PM_{2.5}$	Beta Attenuation/Cont	N/A
			Wind Speed	Anemometer	N/A
			Wind Direction	Wind Vane	N/A
			Temperature	Spot Reading	N/A
Francis School 64 Bourne Avenue E. Providence	440071010	41.840920 -71.36094	Oxides of Nitrogen	Chemiluminescence	Reference
			Nitrogen Dioxide	Chemiluminescence	Reference
			NO/NO_y	Chemiluminescence (low range)	Reference
			Carbon Monoxide	Gas Filter Correlation (low range)	Equivalent
			Sulfur dioxide	Pulsed Fluorescence (low range)	Equivalent
			Ozone	U.V. Photometric	Reference
			$PM_{2.5}$	Lo Vol	Reference
			$PM_{2.5}$	Beta Attenuation/Cont	Equivalent
			Speciated $PM_{2.5}$	Speciation Monitor	N/A
			Coarse PM ($PM_{10-2.5}$)	Lo Vols (PM_{10} & $PM_{2.5}$)	Reference
			Black Carbon	Aethalometer	N/A
			Lead	Lo Vol PM_{10}, XRF	Equivalent
			VOC	Canisters, GC/FID/MS	Reference
			Carbonyls	HPLC Cartridges	Reference
			Wind Speed	Anemometer	N/A
			Wind Direction	Wind Vane	N/A
			Barometric Pressure	Barometer	N/A
			Temperature	Spot Reading	N/A
			Relative Humidity	Plastic Film	N/A
			Solar Radiation	Pyranometric	N/A
			UV Radiation	UV Photometric	N/A
			Precipitation	Bucket/Continuous	N/A

Site	AQS ID	Latitude Longitude	Parameter Measured	Method Of Sampling	EPA Method Designation
Urban League 212 Prairie Avenue Providence	440070022	41.807949 -71.415103	$PM_{2.5}$	Lo Vol	Reference
			$PM_{2.5}$	Beta Attenuation/Cont	N/A
			PM_{10}	Lo Vol	N/A
			PM_{10}/Metals	Hi Vol	Reference
			Chromium VI	TSP/Ion chromatograph	N/A
			VOC	Canisters, GC/FID/MS	Reference
			Carbonyls	HPLC Cartridges	Reference
			Black Carbon	Aethalometer	N/A
			Semi-volatiles	PUF/XAD, GC/MS	N/A
			Wind Speed	Anemometer	N/A
			Wind Direction	Wind Vane	N/A
			Temperature	Spot Reading	N/A
			Relative Humidity	Plastic Film	N/A
Alton Jones Campus Victory Highway West Greenwich	440030002	41.615600 -71.719900	Ozone	U.V. Photometric	Reference
			Nitrogen Dioxide	Chemiluminescence	Reference
			Oxides Of Nitrogen	Chemiluminescence	Reference
			VOC	Canisters, GC/FID/MS	Reference
			PM_{10}	Hi Vol	Reference
			$PM_{2.5}$	Lo Vol	Reference
			$PM_{2.5}$	Beta Attenuation/Cont	Equivalent
			Wind Speed	Anemometer	N/A
			Wind Direction	Wind Vane	N/A
			Barometric Pressure	Barometer	N/A
			Temperature	Spot Reading	N/A
			Relative Humidity	Plastic Film	N/A
			Solar Radiation	Pyranometric	N/A

Network Evaluation

Following is a discussion, by pollutant, of:

- the current monitoring network,
- the NAAQS and a comparison of recent measurements with the NAAQS,
- whether that network meets EPA's monitoring criteria,
- whether new sites are needed,
- whether any existing sites are no longer needed, and
- plans for modification of the network in the next 18 months.

Ozone (O_3)

The sites in the current ozone monitoring network are listed in Table 3:

Table 3 Rhode Island Ozone Monitoring Sites

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE
Alton Jones Campus Victory Highway West Greenwich	Regional (PAMS Type I)	Upwind background Population exposure
USEPA Laboratory 27 Tarzwell Drive Narragansett	Regional	Population exposure
Francis School 64 Bourne Avenue E. Providence	Neighborhood (PAMS Type II)	Maximum precursor emissions impact Population exposure

The NAAQS for ozone is 75 ppb. A site is in violation of that NAAQS when the average of the 4th highest daily eight-hour ozone concentration measured in 3 consecutive years (the design value) at that site exceeds 75 ppb.

Ozone design values for all of the Rhode Island sites have decreased over time, as shown in Table 4 and graphically in Figure 5. In the most recent three year period, 2009-2011, the design values for all three of the sites were below the 75 ppb NAAQS. Based on those design values, EPA designated Rhode Island as an unclassifiable/attainment area for the 75 ppb NAAQS on April 30, 2012. Note, however, that recent design values are affected by the low ozone levels recorded in 2009 due to unusually cool temperatures during the summer of that year.

Table 4 Ozone Design Values (ppb)

	W. Greenwich	Narragansett	E. Providence
2000 - 2002	97	93	91
2001 - 2003	95	95	93
2002 - 2004	87	90	84
2003 - 2005	84	89	82
2004 - 2006	83	85	81
2005 - 2007	86	84	84
2006 - 2008	80	81	82
2007 -2009	77	77	77
2008 - 2010	71	76	72
2009 –2011	73	73	71

EPA's rules require Rhode Island to operate at least two ozone monitors, so the State has one more monitor than the minimum number required. RI DEM believes that it is important to continue to operate all of the current monitors for the following reasons:

- Ground-level ozone levels have decreased in the past several years; however, there continue to be several days each summer when ozone concentrations at one or more of the Rhode Island stations reach unhealthy levels. Note that 8-hour average ozone levels were above 75 ppb at one or more of the Rhode Island monitoring sites on six days in 2011. EPA's Clean Air Scientific Advisory Committee has advocated strengthening the ozone NAAQS to a level in the range of 60 – 70 ppb to protect public health. In 2011, there were 11 days with levels above 70 ppb and 35 days with levels above 60 ppb.

- The three sites represent three distinct geographical areas that are affected by different weather patterns and therefore experience very different ozone levels on some days.

- The availability of real-time ozone data from the three ozone sites enables RI DEM to issue area-specific health advisories as appropriate and to provide residents with real-time information about ozone concentrations and associated health risks in their neighborhoods.

On July 16, 2009, the EPA proposed revisions to its ambient ozone monitoring network design requirements.[2] Those requirements, as proposed, would require additional ozone monitors in rural areas that are not part of MSAs. It is not clear how this requirement would apply to Rhode Island, since all portions of the State, including areas that are commonly considered rural, are part of the Providence-Fall River-Warwick, RI-MA MSA. When that rule is finalized, RI DEM will evaluate the amended requirements and determine what actions are required.

The July 2009 Federal Register Notice also proposed an increase in the length of the ozone season in several states, including Massachusetts and Connecticut. EPA did not propose a change in Rhode Island's ozone monitoring season, April – September, but may do so in the final rule. Although the proposed rule did not change Rhode Island's ozone season, RI DEM has extended the period of operation of its ozone monitors to be consistent with monitoring in neighboring states. Beginning in 2011, the ozone monitors at the Narragansett and East Greenwich sites are being operated from March through October. Note also that, beginning in 2011, ozone is being measured year round at the East Providence site, consistent with NCore requirements.

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[2] EPA, "Ambient Ozone Monitoring Regulations: Revisions to Network Design Requirements," Proposed Rule, Federal Register 74 (135):34525, July 16, 2009. http://frwebgate1.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=166547143810+6+2+0&WAISaction=retrieve

Carbon Monoxide (CO)

The current CO monitoring network is as shown in Table 5:

Table 5 Carbon Monoxide Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE
Francis School 64 Bourne Avenue E. Providence	Neighborhood	Maximum precursor emissions impact Population exposure

The NAAQS for CO are:

- 35 ppm as a 1 hour average, not to be exceeded more than once per year (design value is the highest annual 2nd maximum 1-hour concentration) and
- 9 ppm as an 8 hour average, not to be exceeded more than once per year (design value is the highest annual 2nd maximum non-overlapping 8-hour concentration)

The highest CO design values recorded in Rhode Island in the last five years are:

- 4.5 ppm – 1 hour average, 13 % of NAAQS, recorded at a downtown Providence site[3]
- 2.5 ppm – 8-hour average, 28 % of NAAQS, recorded at a downtown Providence site

The 2011 CO design values for Rhode Island are:

- 1.8 ppm – 1 hour average, 5.1% of NAAQS
- 1.3 ppm – 8 hour average, 14% of NAAQS

The CO NAAQS has not been exceeded in Rhode Island since 1984. Since 2001, all CO levels recorded in Rhode Island have been in the "Good" air quality classification according to the EPA's Air Quality Index (AQI). As shown in Figure 6, there has been a general downward trend in ambient CO levels in Rhode Island in the past ten years, but 8-hour design levels for 2009- 2011 were higher than those for the previous two years.

EPA has no minimum requirements for the number of CO monitors that must be operated in a state, except that CO monitoring is required at Type 2 PAMS sites (40 CFR 58, Appendix D, Table D-6) and, beginning on January 1, 2011, at NCore sites (40 CFR 58, Appendix D 3(b)). Since the East Providence site is a Type 2 PAMS site and the State's NCore site, carbon monoxide monitoring will continue at that site using a low range monitor, consistent with NCore requirements.

[3] Note – Monitoring at Providence site (76 Dorrance Street in downtown Providence) was discontinued on June 28, 2007.

CO monitoring at a site in downtown Providence was discontinued in 2007, after more than 30 years of monitoring at that site. Since CO is generally highest in downtown "urban canyon" areas, that site tended to record higher levels of CO than the levels recorded at other sites and, as such, was used to track maintenance of compliance with the CO NAAQS in the State. When the downtown site was discontinued, EPA required RI DEM to revise its State Implementation Plan (SIP) to provide an alternative mechanism for tracking continued attainment of the CO NAAQS in the State through September 2011. To comply with that requirement, RI DEM submitted the "Providence Carbon Monoxide Limited Maintenance Plan"[4] as a SIP revision to the EPA on September 22, 2008.

In that SIP revision, RI DEM committed to reestablishing a CO monitoring site in downtown Providence within six months if any of the following conditions occurred prior to September 2011:

- The East Providence 8-hour CO design value increased to 5 ppm;
- Total CO emissions for 2008 for Providence County from all anthropogenic source types exceeded 190,883 tons per year or
- Average motor vehicle CO emissions measured by the State's remote sensing program exceeded 0.39%.

None of the above trigger conditions have occurred. The 8-hour CO design value for the East Providence CO monitor in 2011 was 1.3 ppm, 26% of the ambient monitoring trigger value. 2008 anthropogenic source CO emissions for Providence County were 90,800 tons, 48% of the emissions trigger value. The average motor vehicle CO emissions were 0.12% in 2010, the most recent year for which those data are available; that value is the same as in the previous year and 31% of the motor vehicle trigger value. Given that none of the above trigger conditions have occurred and that the maintenance period ended in September 2011, the State does not plan to resume CO monitoring in downtown Providence.

On August 21, 2011, EPA issued a decision retaining the CO NAAQS at the current levels.[5] The decision requires the operation of CO monitors at near-road sites established according to the 2010 NO_2 NAAQS for all urban areas which, like the Providence-New Bedford-Fall River, RI-MA MSA, have a population of 1,000,000 or more. Near-road CO monitoring is not required until January 1, 2017; however, Rhode Island plans to purchase a low-range CO monitor with the funds provided by EPA to states for setting up near-road sites and will begin measuring CO at that location as soon as the site and equipment are operational. Plans for establishing the near-road site are discussed below

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[4] RI DEM, "Providence Carbon Monoxide Limited Maintenance Plan," September 2008, http://www.dem.ri.gov/programs/benviron/air/pdf/provcomp.pdf

[5] US EPA, "Review of National Ambient Air Quality Standards of Carbon Monoxide: Final Rule," Federal Register 76 (169):54294, August 3, 2011. http://www.gpo.gov/fdsys/pkg/FR-2011-08-31/pdf/2011-21359.pdf

in the NO_2 section of this document. RI DEM does not plan any other changes in the State's carbon monoxide monitoring network in the next 18 months.

Sulfur Dioxide (SO_2)

The current SO_2 monitoring network is as shown in Table 6:

Table 6 Sulfur Dioxide Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE
Brown University 10 Prospect Street Providence	Neighborhood	Population exposure
Francis School 64 Bourne Avenue E. Providence	Neighborhood	NCore

The NAAQS for SO_2[6] are:

- 75 ppb, 1-hour average (primary standard effective June 2, 2010). The design value is the average of the 99th percentile maximum daily hour measured in 3 consecutive years

- 0.5 ppm (500 ppb) - 3 hour average (secondary standard), not to be exceeded more than once per year

The highest SO_2 design values recorded in the last five years in Rhode Island are:

- 38 ppb - 1 hour average, 51% of primary NAAQS
- 31 ppb - 3-hour average, 6% of secondary NAAQS

The 2011 SO_2 design values are:

- 23 ppb – 1 hour average, 31% of NAAQS
- 20 ppb- 3 hour average, 4% of NAAQS

The SO_2 NAAQS has never been exceeded in the State. One-hour design values have been below 75 ppb, the one-hour NAAQS promulgated in 2010, since 1994. All measurements have been in the "Good" range of the AQI since 2007. As shown in Figure 7, one-hour average SO_2 design levels in

[6] An EPA rule amending the SO_2 NAAQS was signed on June 2, 2010. The rule revokes the previous annual and 24-hour NAAQS and sets a new one-hour average NAAQS at 0.075 ppm (75 ppb). Revisions of monitoring networks consistent with the requirements in the rule must be in place by January 1, 2013.

Rhode Island have declined over the past decade.

EPA's 2006 amended monitoring regulation requires SO_2 monitoring only at NCore sites. However, the 2010 SO_2 NAAQS rule requires at least one SO_2 monitor in the Providence-New Bedford-Fall River RI, MA MSA, which includes all of Rhode Island and Bristol County, Massachusetts. That SO_2 monitor must be sited to meet one or more of the following objectives: (1) characterizing concentrations around emissions sources, (2) measuring the highest concentrations in an area, (3) determining population exposure, (4) establishing general background levels and (5) evaluating regional transport.

Rhode Island operates a SO_2 monitor at Brown University in Providence and, to meet NCore requirements, began operating a low-range SO_2 monitoring at the East Providence site in January 2011. Note that, in the first year of its operation, the 99^{th} percentile one-hour concentration at the East Providence site, 26 ppb, was higher than that at the Brown University site, 21 ppb. RI DEM believes that the Brown University and E. Providence monitors appropriately characterize population exposure in the major urban area in Rhode Island.

The State of Massachusetts also operates a SO_2 monitor in the Providence-New Bedford-Fall River RI-MA MSA. Since that monitor is located in Fall River, MA, approximately two miles southeast of Dominion Energy- Brayton Point, a coal-fired power plant, the SO_2 levels recorded at that site tend to be substantially higher than those at the Rhode Island sites. The 2011 99^{th} percentile one-hour SO_2 levels at the Fall River monitor was 64.9 ppb, 86.5% of the NAAQS and approximately three times the levels measured in Rhode Island. According to EPA's Emissions Inventory System (EIS), in 2008 the Brayton Point facility emitted 30,085 tons of SO_2, more than 100 times higher than those from the largest Rhode Island source, Central Landfill (268 tons). Therefore, the Fall River monitor is more appropriate than a Rhode Island location for characterizing maximum concentrations in the MSA. Note that, since the Brayton Point facility is less than two miles east of the border with Bristol County, Rhode Island, maximum SO_2 levels in that county may be better represented by levels measured at the Fall River site than by those at the Rhode Island sites.

The 2010 SO_2 NAAQS rule requires states to conduct dispersion modeling of large SO_2 emitting sources and stipulates that the EPA will use of the modeling results, in addition to monitoring data, to determine whether areas are in attainment of that standard. However, in response to comments received subsequent to the promulgation of the 2010 NAAQS, EPA is reviewing the monitoring and modeling requirements in that rule to reevaluate the implementation approach for the one-hour NAAQS. When those requirements are finalized, RI DEM will determine whether the current sites meet the monitoring specifications and whether continued operation of the Providence site is necessary.

Nitrogen Dioxide (NO_2)

The current NO_2 monitoring network is shown in Table 7:

Table 7 Nitrogen Dioxide Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Brown University 10 Prospect Street Providence	Neighborhood	Population exposure	Continuous Year round
Francis School 64 Bourne Avenue E. Providence	Neighborhood (PAMS)	Population exposure	Continuous Ozone season
Alton Jones Campus Victory Highway West Greenwich	Regional (PAMS)	Population exposure Upwind background	Continuous Ozone season

The NO_2 NAAQS are:

- 100 ppb - 1 hour average (effective January 22, 2010). The design value is the average of the 98^{th} percentile maximum daily hour measured in 3 consecutive years.

- 0.053 ppm (53 ppb) - annual average

The highest NO_2 design values recorded in the last five years are:

- 51 ppb - 1 hour average, 51% of NAAQS
- 14 ppb - annual average, 26% of NAAQS

Design values for 2011 are:

- 44 ppb - 1 hour average, 44% of NAAQS
- 11 ppb annual average, 21% of NAAQS

The NO_2 NAAQS have never been exceeded in Rhode Island. Since there was no short-term NAAQS for nitrogen dioxide until the standard was amended in 2010, this pollutant was not used for the Air Quality Index (AQI) before that date. The amended NO_2 NAAQS rule, which was published on February 9, 2010[7], establishes hourly levels of 54- 100 ppb as the range for a "Moderate" AQI .

[7] USEPA, "Primary National Ambient Air Quality Standards for Nitrogen Dioxide: Final Rule," FR 75(26):6474, 9 February 2010. http://www.epa.gov/ttn/naaqs/standards/nox/fr/20100209.pdf

In the 5 year period of 2007 – 2011, there were a total of 7 days when levels recorded in Rhode Island were in that range. No levels in the "Unhealthy for Sensitive Populations" or more serious AQI categories were recorded in that period.

The 2010 amended NO_2 NAAQS requires Rhode Island to operate two NO_2 monitoring sites, one at "a location of expected highest NO_2 concentrations representing the neighborhood or larger spatial scales" and a second monitor in a near-road location where maximum microscale-representative concentrations are expected. Plans for these sites must be submitted to EPA by July 1, 2012 and the sites must be operational in 2013. Those plans are delineated below.

Rhode Island has operated a NO_2/NOx monitor year round at the Brown University site in Providence since 1994; therefore, the data collected at that site are useful for tracking trends in concentrations of those pollutants over time. In addition, monitors measuring NO_2 and NO_x are operated at the State's two PAMS sites (W. Greenwich and E. Providence) during the ozone season.

The Brown University monitor is approved as a neighborhood scale representative NO_2 monitor. The monitor is in the area of the state with the highest amount and density of emissions of nitrogen oxides. While Providence comprises only 2% of Rhode Island's land area, in 2008 28% of the State's total NO_2 point source emissions were emitted by Providence sources. Since 17% of the State's population lives in Providence, a substantial portion of the State's area source emissions (e.g. from home heating oil combustion) also occur in the Providence area. Therefore, RI DEM believes that the current Brown University monitoring location meets EPA's criteria to be the State's area-wide site for determining compliance with the 2010 NO_2 NAAQS. NO_2 concentrations measured at that site are substantially lower than the NAAQS for that pollutant, including the newly promulgated 1-hour average standard.

As discussed above, NO_2 is currently monitored at the E. Providence PAMS site during the ozone season. However, RI DEM has ordered low range NO_2 monitors to replace the conventional NO_2 monitors at all three Rhode Island NO_2/NOx sites and, once those monitors are installed, the E. Providence monitor will be operated year-round for at least a one-year period to compare one-hour results at that site with those at Brown University.

The NO_2 NAAQS rule directs states to select a near-road monitoring location that is adjacent to a road segment with one of the highest Average Annual Daily Traffic (AADT) counts in the area, considering "fleet mix, roadway design, congestion patterns, terrain, and meteorology." In December 2011, the EPA issued a draft Technical Assistance Document (TAD)[8] which identifies methods for considering those factors.

[8] US EPA, "Draft Near-Road NO_2 Monitoring Technical Assistance Document," Dec. 21, 2011. http://www.epa.gov/ttn/amtic/files/nearroad/20111221tad.pdf

EPA's Near-Road TAD directs that, as a first step in identifying a near-road site, the State should rank roadway segments by AADT. According to Rhode Island Department of Transportation (RI DOT) data[9], the road segments in Rhode Island with the highest AADT are, in descending order the following segments of Interstate Route 95 (I-95):

I-95 Segment	AADT
US. 6 to RI 146, Providence	186300
Elmwood Ave. to Eddy St., Providence	176700
RI 117 to I-295, Warwick	166100
TF Green Airport to RI 37, Warwick/Cranston	151100
RI 4 to RI 117, Warwick	148700
I-295 to TF Green, Warwick	141300
RI 146 to Branch Ave, Providence	137100
I-195 to US 6, Providence	136800
RI 37 to RI 10, Cranston	135300

Note that these AADT figures are based on data collected between 2004 and 2008, and, due to the highway construction and reconfiguration projects discussed below, those data are not completely applicable to current and future traffic conditions in Rhode Island. Specifically, due to deteriorating bridge conditions, RI DOT posted an 18 ton weight limit on a bridge on I-95 in Pawtucket, immediately north of Providence, in late 2007, closing that section of the highway to large trucks. This restriction was lifted for northbound traffic in April 2012 and is expected to be lifted for southbound traffic later this year but, in the interim, interstate trucks have been advised to detour onto I-295 to circumvent the Providence metropolitan area. This detour has substantially reduced truck traffic in the Providence area while the restriction is in place.

In addition, the State has recently completed a massive bridge and highway construction project known as the Iway Project, which moved the I-95 - I-195 interchange in Providence south of its former location and changed the locations of several highway entrance/exit ramps in that area. The first section of the new interchange, connecting northbound I-95 to eastbound I-195, opened in November 2007 and the final section, connecting northbound I-95 to westbound I-195, in October 2009. Additional construction and demolition activity continued in the area for two more years, until the final ramp opened in October 2011. Since much of the AADT data were collected prior to the opening of the new interchange, the relative traffic counts for specific road segments in that area may not be reflective of current conditions.

All data indicate, however, that the highest AADT in the State occurs on the section of I-95 that passes through downtown Providence, north of the I-195 interchange and south of RI-46. Other

[9] RI DOT, in cooperation with US DOT and FHWA, "State Highway Map of Rhode Island: Traffic Flow Map," 2009. http://www.dot.state.ri.us/documents/gis/maps/SM02.pdf

segments of I-95 with high AADT include the segment immediately south of downtown Providence; segments in the Warwick-Cranston area in the vicinity of TF Green Airport, the malls, and I-295; and the segment just north of the RI-46 exit near the Providence/Pawtucket line.

The TAD specifies methodology for quantitatively considering diesel AADT when identifying a near-road monitoring site. However, as discussed above, interstate trucks have largely avoided travel on I-95 through the Providence area in recent years because of the weight restrictions on the Pawtucket I-95 bridge. Therefore, recent diesel RI DOT AADT data are not representative of current and future truck traffic conditions and a quantitative analysis of this variable was not possible. It is clear, however, that, as the weight limit restrictions are lifted, interstate truck traffic on I-95 is resuming. When interstate truck traffic returns to normal levels, I-95 road segments in the Providence area will again have diesel traffic counts that are among the highest in the State.

To consider congestion, RI DEM obtained monthly I-95 Weekday Speed Profiles prepared by RI DOT for January – April 2012. The profiles for each of those months are nearly identical. The April 2012 profile, which is displayed as Figure 8, shows significant rush hour congestion in the Providence metropolitan area, particularly during the afternoon rush period (3:30 – 6:30 PM). In the southbound direction, the worst congestion occurs north of the RI-146 merge, where average speeds were 30 mph during the afternoon rush and 45 mph during the morning rush period (6:30 – 9:30 AM). That segment has the 7th highest AADT. The second most congested I-95 segment for southbound traffic is south of the RI-146 merge, the segment with the highest AADT (average morning and afternoon rush hour speeds 50 and 45 mph, respectively). For northbound traffic, congestion begins farther south. In the afternoon rush hour, the average speed for all Providence segments of I-95 was 35- 40 mph.

To consider meteorology, RI DEM evaluated the distribution of wind directions recorded at the Urban League monitoring site in Providence in the years 2008-2010. The Urban League site is located approximately ½ mile west of I-95 in Providence, immediately south of the downtown area. As shown in Figure 9, the predominant wind directions at that site are from the west to west-northwest range and from the southwest to south range. As can be seen in the figure, the wind direction distribution during the rush hour periods (6:00 AM -10:00 AM and 3:00 PM – 6:00 PM), when traffic and congestion is highest, is nearly identical to the distribution during all hours. As can be seen in Figure 10, the predominant wind direction during the warmer months (April – September) is southwest to south, while the predominant direction in the cooler months (October – March) is northwest to west-northwest. Since I-95 runs north-south, the monitor would be situated either east or west of the highway. As shown in Figure 11, wind directions with a westerly component predominate year-round.

Therefore, to measure maximum impacts, the monitor should ideally be located on the east side of I-95. And, considering AADT, diesel traffic and congestion, the ideal location would be on the on a segment of I-95 near the downtown Providence area.

The TAD indicates that the near-road monitor location should be level with the roadway. This restriction, along with other land-use and safety considerations, severely limits possible site locations in the Providence area. RI DEM has tentatively identified a location that would meet the established criteria and has begun discussions with RI DOT about the possible use of that land for a monitoring site. If that location is not available, it may be necessary to compromise on one or more of the optimal siting criteria, and RI DEM will seek input from EPA Region I concerning that decision.

Monitoring of NO_2 and CO is required at the near-road site. In June 2012, EPA proposed an amended particulate matter NAAQS rule that also would require $PM_{2.5}$ monitoring at the near-road site. Additional parameters, such as meteorology, traffic counts and concentrations of black carbon, VOC and ultrafine particles, may also be monitored at the Providence near-road site if sufficient funds remain after the required equipment is purchased and the site is installed. RI DEM plans to begin operating the site in calendar year 2013.

Particulate Matter

Particles smaller than 10 microns (PM_{10})

The current PM_{10} monitoring network is as shown in Table 8 and Figure 2:

Table 8 PM_{10} Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Vernon Trailer Vernon Street Pawtucket	Middle	Population exposure	24-hour 1 in 6 day
Johnson & Wales 111 Dorrance Street Providence	Neighborhood	Population exposure	24-hour 1 in 6 day
Urban League 212 Prairie Avenue Providence	Neighborhood (NATTS)	Population exposure Highest concentration	24-hour 1 in 6 day
Alton Jones Campus Victory Highway West Greenwich	Regional	Upwind background	24-hour 1 in 6 day
Francis School 64 Bourne Avenue E. Providence	Neighborhood (NCore)	Population exposure (Lead and $PM_{10-2.5}$	24-hour 1 in 6 day

The PM_{10} NAAQS is:

- 150 $\mu g/m^3$ – 24-hour average, not to be exceeded more than once per year on average over 3 years (design value is 4th high value in a 3-year period)

The highest PM_{10} value recorded in Rhode Island in the last five years is

- 62 $\mu g/m^3$ – 24-hour average, 41% of NAAQS, recorded at Vernon St. in 2009

The highest 4th high PM_{10} value recorded at a Rhode Island site for the 2009 – 2011 period is:

- 43 $\mu g/m^3$ – 24-hour average, 29% of NAAQS, recorded at Vernon St.

The PM_{10} NAAQS has never been exceeded in Rhode Island and, since PM_{10} is measured using a filter-based method, results are not immediately available and cannot be used for Air Quality Index calculations. Trends in PM_{10} design values are shown in Figure 12. Levels tend to be highest at the Vernon Street site, which is adjacent to I-95, and higher at the two Providence sites than at the rural W. Greenwich site. There is no clear temporal trend in the PM_{10} levels observed over the past decade.

Since late 2011, PM_{10} is also measured at the E. Providence NCore site every sixth day, using a lo-vol sampler. Those PM_{10} measurements are used, in conjunction with $PM_{2.5}$ measurements at that site, for calculating $PM_{10-2.5}$ levels. The lo-vol PM_{10} filters are also used for lead measurements.

EPA's monitoring regulations require areas like the Rhode Island MSA, which has a population greater than 1,000,000 and measured PM_{10} concentrations below 80% of the NAAQS, to operate a minimum of 2-4 PM_{10} monitoring sites. Since Rhode Island is currently operating five sites and is not measuring levels close to the NAAQS at any of the sites, one or more sites could be discontinued without violating the minimum criteria. Note that the Vernon Street site was not operated for much of the first two quarters of calendar year 2012, due to heavy construction in the immediate area of that site. Monitoring at that site will resume by July 1, 2012.

As discussed above, PM_{10} measurements at the E. Providence site are used for calculating $PM_{10-2.5}$ levels and, since this measurement is required at NCore sites, PM_{10} sampling cannot be discontinued at that site. Similarly, PM_{10} samples collected at the Urban League site in Providence are analyzed for metals to fulfill NATTS requirements, so PM_{10} sampling at that location cannot be discontinued. The rural Alton Jones, West Greenwich site provides useful information about background concentrations of PM_{10} in Rhode Island. The Vernon St., Pawtucket site, which is adjacent to I-95, tends to record the highest PM_{10} concentrations in the State. Therefore, the Johnson & Wales Library in downtown Providence is the only site that is being considered for possible discontinuation at this time.

The Johnson & Wales site is approximately one mile from the Urban League location. In the eight years that the Johnson & Wales site has been operational, the PM_{10} design values at that site have been, on average, 2.4 $\mu g/m^3$ higher than those at the Urban League site and 9.8 $\mu g/m^3$ lower than those at the Vernon Street, Pawtucket site. The PM_{10} levels at the Johnson & Wales site correlate well with those at the Urban League ($r^2 = 0.86$). Since operation of the Johnson & Wales site is currently not resource-intensive, RI DEM plans to continue to operate this site for the present. If the continued operation of this site becomes problematic, RI DEM will seek EPA approval to discontinue monitoring at Johnson & Wales.

Fine Particulate Matter (Particulate Matter smaller than 2.5 microns, or $PM_{2.5}$)

The current Federal Reference Method/Federal Equivalent Method (FRM/FEM) $PM_{2.5}$ monitoring network is shown in Table 9 and in Figure 3:

Table 9 $PM_{2.5}$ FRM/FEM Monitoring Network

SITE	MEASUREMENT SCALE	MONITORING OBJECTIVE	SCHEDULE
Vernon Trailer Vernon Street Pawtucket	Middle	Population exposure	24-hour 1 in 3 day
Hallmark Building 695 Eddy Street Providence	Urban	Population exposure	24-hour 1 in 3 day
Urban League 212 Prairie Avenue Providence	Neighborhood	Population exposure Highest concentration	24-hour daily
Francis School 64 Bourne Avenue E. Providence	Urban	Population exposure Highest concentration	24-hour daily
Alton Jones Campus Victory Highway West Greenwich	Regional	Population exposure General/Background Regional Transport	Continuous FEM, 1 in 6 day co-located sampler

Filter-based FRM $PM_{2.5}$ units are operated as the primary samplers at the first four sites listed above and a FEM continuous $PM_{2.5}$ monitor is the primary sampler at the West Greenwich site. Continuous $PM_{2.5}$ monitors are also operated at the Urban League site, the US EPA Laboratory in Narragansett and the East Providence NCore site but are not used to determine compliance with the NAAQS. A filter-based FRM sampler is operated every 6^{th} day at the West Greenwich site for quality assurance purposes. Note that the Vernon Street site was not operated for much of the first two quarters of calendar year 2012, due to heavy construction in the immediate area of the monitors. Monitoring at that site will resume by July 1, 2012.

The $PM_{2.5}$ NAAQS are:

- 35 µg/m^3 – 24-hour average (design value is the 3-year average of the 98th percentile 24-hour concentration)
- 15 µg/m^3- annual average (design value is calculated by averaging the daily concentrations from each quarter, averaging these quarterly averages to obtain an annual average, and then averaging the annual averages for three consecutive years)[10]

The highest $PM_{2.5}$ design values recorded in Rhode Island in the last 5 years are:

- 30 µg/m^3 – 24-hour average, 86% of NAAQS, recorded at Vernon St.
- 12.0 µg/m^3 – annual average, 80% of NAAQS, recorded at Vernon St.

The highest $PM_{2.5}$ design values for 2011 are:

- 24 µg/m^3 – 24-hour average, 69% of NAAQS, recorded at E. Providence
- 9.4 µg/m^3 – annual average, 63% of NAAQS, recorded at Vernon St.

Although none of the monitors violate the NAAQS (including the proposed revised annual average NAAQS), $PM_{2.5}$ levels at one or more sites in the State were at or above 35 µg/m^3 and, therefore, the air quality was unhealthy, on five days in the past five years (2007 – 2011). Note also that many members of the scientific community believe that the 24-hour $PM_{2.5}$ NAAQS should be more stringent than the current standard, e.g. at a level of 30 µg/m^3, to be protective of public health. In the 2007-2011 period there were 18 days with concentrations at or above that concentration at one or more Rhode Island sites.

EPA regulations require a minimum of two $PM_{2.5}$ monitoring sites in Rhode Island. These sites must characterize the following:

- Community-wide air quality;
- Background $PM_{2.5}$ levels in the State; and
- Regional transport of $PM_{2.5}$.

Rhode Island currently operates more $PM_{2.5}$ sites than minimally required. The West Greenwich site is necessary to the network because it fulfills EPA's requirements for measuring background levels and regional transport of this pollutant. As shown in Figures 13 and 14, the 24-hour and annual $PM_{2.5}$ design values for the Vernon Street site tend to be higher than those at the other sites, so that

[10] In June 2011, EPA released a proposed revision to the PM NAAQS, which would reduce the annual average $PM_{2,5}$ NAAQS to 12-13 µg/m^3 and would add a secondary $PM_{2.5}$ NAAQS to address urban visibility issues. The proposed NAAQS would leave the PM_{10} NAAQS and the 24-hour average $PM_{2.5}$ NAAQS unchanged.

site cannot be removed from the network. The E. Providence site also cannot be removed because $PM_{2.5}$ monitoring is required at NCore sites.

Therefore, the only two $PM_{2.5}$ sites that could potentially be removed are the Urban League and the Eddy Street sites, which are approximately 0.4 miles apart from each other in the south side of Providence. The $PM_{2.5}$ measurements at both of these sites for the period 2007-2011 correlate well with concurrent values at the other two urban sites, Vernon Street and E. Providence ($r^2 \geq 88\%$) .

As shown in Figures 13 and 14, 24-hour and annual average $PM_{2.5}$ design values at all five Rhode Island $PM_{2.5}$ sites are substantially below the applicable NAAQS and have decreased over the past several years, although levels in 2011 were slightly higher than those in 2010 at some of the sites. On days that both monitors were running, $PM_{2.5}$ concentrations at the Urban League and Eddy Street sites were, on average, approximately 2 $\mu g/m^3$ higher than at the rural Alton Jones site, less than 1 $\mu g/m^3$ higher than at the East Providence site and approximately 1 $\mu g/m^3$ lower than at the Vernon Street site. .

Since $PM_{2.5}$ concentrations at both the Urban League and Eddy Street sites tend to be lower than those at Vernon Street, the removal of those sites would not be likely to result in an underestimation of $PM_{2.5}$ concentrations in the Providence metropolitan area. However, maintenance of at least one of those sites is important to provide information about typical $PM_{2.5}$ concentrations in urban Rhode Island neighborhoods that are not immediately adjacent to a highway.

RI DEM is not proposing to eliminate either of these sites at this time. $PM_{2.5}$ has been measured daily at the Urban League site since the inception of that monitoring program in 1997, and so measurements at that site provide useful long-term trends data. In addition, RI DEM measures a number of other parameters at the Urban League location, including PM_{10}, PM_{10} metals, continuous $PM_{2.5}$, black carbon, volatile organic compounds, semi-volatile compounds and carbonyls, so that site provides a comprehensive picture of exposures of potential public health concern in urban areas of the State.

The Eddy Street site, which has been operational since 2004, is located in an area that has been in flux for several years due to its proximity to the Iway highway reconstruction project discussed above. That project was completed in October 2011. RI DEM plans to continue $PM_{2.5}$ monitoring at that site at least until the end of 2012 in order to evaluate $PM_{2.5}$ levels in that area since the new highway pattern has been completed. If it is determined at that time that the levels at that site are similar to those at the other sites, RI DEM will discuss possible discontinuation of $PM_{2.5}$ monitoring at that site with the EPA. Note that the Eddy Street monitor is on the roof of a building that is currently for sale. If the building is sold and the new owners are not amenable to continuing operation of the monitor, the monitor will be removed.

As discussed above, the proposed revised $PM_{2.5}$ NAAQS rule requires $PM_{2.5}$ monitoring at the near-road site. RI DEM plans to monitor for $PM_{2.5}$ at that location when a near-road site is established. No other changes to the $PM_{2.5}$ network are planned in the near future.

Lead (Pb)

On November 12, 2008, the EPA promulgated an amended NAAQS for lead (FR 73:66964). The new NAAQS is an order of magnitude more stringent than the previous value. To determine whether an area is in compliance with the new standard, EPA is requiring two types of lead monitoring: source- specific monitoring in the vicinity of each lead source that emits 0.5 or more tons of lead per year and area-wide lead monitoring at urban NCore sites. Rhode Island has no sources emitting 0.5 tons or more of lead per year and, therefore, is not required to operate any source-specific monitors. To fulfill the requirement for area-wide monitoring, RI DEM and RI DOH began collecting lo-vol PM-10 samples, which are analyzed for lead, at the E. Providence NCore site in May 2011. Those filters are currently being analyzed by the State of Maine using EPA-approved XRF methodology. In June 2012, EPA approved the use of ICP/MS analyzers to measure lead collected on lo-vol filters. Rhode Island plans to switch to this method so that the analysis can be conducted at the RI DOH Air Pollution Laboratory within the next year, after the laboratory has verified that it can obtain accurate results using that methodology. As specified in the lead NAAQS rule, sampling will be conducted on a one-in-six day schedule.

Ozone Precursor and Air Toxics Measurements

Photochemical Assessment Monitoring Stations (PAMS)

The Clean Air Act Amendments of 1990 (CAAA) required serious, severe and extreme ozone nonattainment areas to establish enhanced monitoring networks to measure ozone and ozone precursors. In response to that mandate, the US EPA promulgated rules in 1993 that required the establishment of a network of Photochemical Assessment Monitoring Stations (PAMS) to measure ozone; NO_x; volatile organic compounds (VOCs), carbonyls, and meteorological parameters in serious and above nonattainment areas. This network was designed to provide comprehensive data on trends in ambient concentrations of ozone, NO_x and VOC species and to evaluate the spatial and diurnal variability of those pollutants. Those data are used to track the formation and transport of ozone across large areas and to evaluate the effectiveness of strategies implemented to reduce levels of that pollutant.

The EPA rule identifies four types of PAMS sites:

- Type 1 sites, located on the upwind side of the nonattainment area and used to characterize background and transported concentrations of ozone, NO_x and VOC;

- Type 2 sites, sited to measure the maximum impact of VOC and NO_x emitted in the area;

- Type 3 sites, sited to measure maximum ozone concentrations occurring downwind of the area, and

- Type 4 sites, sited to measure the concentration of ozone, NO_x and VOC exiting the area.

Two PAMS sites, including a Type 2 site, are required in each serious and above nonattainment area. Since Rhode Island was a serious nonattainment area for the one-hour average ozone NAAQS, the ozone standard that was in effect at the time the enhanced monitoring requirements were promulgated, a PAMS network is required in the State. The Alton Jones monitoring site in W. Greenwich is designated as the State's Type 1 PAMS site and the E. Providence site as a Type 2 PAMS site. In addition, the Massachusetts Department of Environmental Protection (MA DEP) operates a site at the Blue Hills Observatory in Milton, Massachusetts that serves as the Type 1 (upwind) site for the Boston area and has served as the Type 3 (downwind) site for the Providence area.

Rhode Island monitors the following PAMS pollutants:

- 24-hour speciated Volatile Organic Compounds (VOC) samples are collected every sixth day year round at the Type 1 and Type 2 sites and eight 3-hour VOC samples are collected every day during June, July and August at the Type 2 site. Eight 3-hour samples were collected every third day during June July and August in 2011 at the Type 3 station in Milton, MA, but MA DEP is not collecting 3-hour VOC samples in 2012, due to staffing limitations. Eight 3-hour VOC samples per day are also collected at the Type 1 site in W. Greenwich during a limited number of ozone episodes in the summer months.

- 24-hour carbonyl samples are collected year round and eight 3-hour carbonyl samples per day were collected every third day during June, July and August through 2011 at the Type 2 site. 3-hour carbonyl samples are required only in nonattainment areas classified as serious or above for the 8-hour ozone standard. Since Rhode Island has never had a nonattainment classification higher than "moderate" for that NAAQS, this requirement does not apply to the State. Rhode Island collected the 3-hour samples through the 2011 PAMS season but is not collecting 3-hour carbonyl samples in 2012.

- NO_x has historically been measured continuously at the Type 1 and Type 2 sites during June, July and August. Since EPA requires NO_x monitoring at the Type 2 site for the entire ozone season, Rhode Island continued NO_x monitoring at the E. Providence site through the end of the ozone season (September 30th) in 2011 and will thereafter operate that monitor for the entire ozone season. In 2012, the NO_x monitors at the Rhode Island sites will be replaced with low-range monitors. NO_x is also measured by MA DEP at the Milton, MA site, the Type 3 site for Rhode Island, during the ozone season.

- Rhode Island began measuring reactive nitrogen oxides (NO_y) at the Type 2 site in January 2011 to fulfill NCore requirements. EPA regulations require NO_y measurements at one Type 3 or Type 1 PAMS site during the ozone season. Rhode Island currently monitors NO_x, but

not NO_y, at its Type 1 site. Similarly, NO_x, rather than NO_y, is monitored at the Type 3 site in Milton, MA, although MA DEP has measured NO_y at that site in the past. Rhode Island does not have any immediate plans to install NO_y equipment at the Type 1 site.

- CO is measured year round at the Type 2 site. In 2010, the conventional CO monitor at that site was replaced with a low-range (ppb) CO monitor, in fulfillment of both NCore and PAMS network requirements.

- Ozone is measured during the ozone season at all three sites. Beginning in 2011, ozone is measured year-round at the Type 2 site to fulfill NCore requirements.

- Surface meteorological parameters are measured at all three sites year-round.

- Rhode Island uses the upper air data collected at the Brookhaven, New York meteorological site to fulfill the PAMS requirements for those measurements

Note that the PAMS program is currently being reviewed to determine whether changes in site locations, pollutants monitored, or monitoring methods are necessary to obtain the most appropriate and cost-effective data for assessing ozone formation and transport of ozone and precursors. If the EPA decides to link PAMS requirements to a state's attainment status for the current ozone NAAQS, rather than the former one-hour NAAQS, PAMS sites may no longer be required in the State.

Air Toxics

Rhode Island operates a site that is part of the National Air Toxics Trends Stations (NATTS) network. The primary purposes of the NATTS network are to track trends in ambient air toxics levels, to characterize exposures, and to measure progress toward emission and risk reduction goals.

The Rhode Island NATTS site is located on the roof of the Urban League building in an urban residential area in South Providence approximately ½ mile west of I-95. The Urban League building houses a variety of community services, including a health clinic and day care center. This site was chosen as the State's NATTS site because it is not dominated by local sources and levels of air toxics at this site appear to be representative of those in urban areas in the State

In keeping with EPA requirements, the following pollutants, at a minimum, are measured at the Rhode Island NATTS site:

Volatile Organic Compounds (VOC)

- Acrolein
- Perchloroethylene (tetrachloroethylene)

- Benzene
- Carbon tetrachloride
- Chloroform
- Trichloroethylene
- 1,3-butadiene
- 1,2-dichloropropane
- Dichloromethane
- Vinyl Chloride

Carbonyls
- Formaldehyde
- Acetaldehyde

Metals
- Nickel compounds (PM_{10})
- Arsenic compounds (PM_{10})
- Cadmium compounds (PM_{10})
- Manganese compounds (PM_{10})
- Beryllium (PM_{10})
- Lead (PM_{10})
- Hexavalent chromium (TSP)

Semi-Volatile Organic Compounds (SVOC)
- Benzo(a)pyrene
- Napthalene

VOC, carbonyls and PM_{10} metal samples are analyzed by RI DOH. Hexavalent chromium and SVOC samples are analyzed by an EPA contractor. Sampling at the NATTS site is conducted for all of the above parameters for 24-hour periods every sixth day. 24-hour VOC samples are also collected every sixth day at the PAMS sites in W. Greenwich and E. Providence and at the Vernon Street, Pawtucket site, which is adjacent to I-95 in Pawtucket. 24-hour carbonyl samples are collected at the E. Providence site on the same schedule.

In addition, RI DEM and RI DOH operate aethalometers, which measure black carbon, an indicator of diesel exhaust, at the Urban League NATTS site and the E. Providence Type 2 PAMS site.

RI DEM is not planning any changes to the ozone precursor or air toxics monitoring sites in the next 18 months, unless EPA promulgates changes to the PAMS program that are effective during that period.

National Core (NCore) Multi-pollutant Monitoring Stations Network

As required in an October 17, 2006 Federal Register notice (FR 71:61236), Rhode Island began operating a site that is part of the network of core multipollutant monitoring (NCore) stations in January 2011. This network is designed to address the following monitoring objectives:

- timely reporting of data to the public through AIRNow, air quality forecasting, and other public reporting mechanisms
- supporting development of emission strategies through air quality model evaluation and other observational methods
- accessing accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors
- supporting long-term health assessments that contribute to ongoing reviews of the NAAQS
- establishing nonattainment/attainment areas by comparison with the NAAQS
- supporting multiple disciplines of scientific research, including; public health, atmospheric and ecological.

The Rhode Island Type 2 PAMS site in E. Providence is now fully operational as the State's NCore site. Ozone, NO_2/NO_x, reactive oxides of nitrogen (NO_y), low-range CO, low range SO_2, $PM_{2.5}$ (FRM, continuous and speciated), coarse PM ($PM_{10-2.5}$), VOCs, carbonyls, black carbon, lead in lo-vol PM_{10}, and meteorological parameters are monitored at that site. To conform to EPA quality assurance requirements, the dichotomous sampler previously used to measure $PM_{10-2.5}$ has been discontinued, and $PM_{10-2.5}$ is now measured as the difference between lo-vol PM_{10} and lo-vol $PM_{2.5}$ concentrations. Rhode Island has no plans to change NCore monitoring in the next 18 months.

Summary of Proposed Changes in the Rhode Island Monitoring Network

In summary, RI DEM plans to modify the current monitoring network as follows:

- RI DEM plans to replace all of it NO_2/NO_x monitors with low range units later in 2012 and to operate the East Providence NO_2 monitor year-round for at least one calendar year to compare cold weather one-hour concentrations at that site with those measured at the Brown University site.

- If operation of the PM_{10} monitoring at Johnson & Wales in Providence becomes problematic, RI DEM may ask EPA for authorization to discontinue monitoring at that site.

- RI DEM may request that $PM_{2.5}$ monitoring at the Eddy Street site in Providence be discontinued if operation of this site becomes problematic when the building is sold or if an evaluation of the data collected since the completion of the 1-95 reconstruction project shows that current $PM_{2.5}$ levels at the site are similar to those at the nearby Urban League site.

- A near-road monitoring site measuring, at a minimum, CO, NO_2, and $PM_{2.5}$[11], will be established and will begin operation in 2013.

- After the RI DOH Laboratory verifies that it can accurately measure lead concentrations in lo-vol PM_{10} samples, Rhode Island plans to begin to analyze its lead samples in-house using EPA's newly approved ICP/MS methodology.

RI DEM understands that all network modifications that involve discontinuation or moving of any sites are subject to EPA approval, even if the remaining network meets EPA's minimum requirements.

[11] This assumes that the final PM NAAQS will require near-road monitoring for that pollutant.

Figure 1
Air Quality Monitoring Network
Continuous Monitors
Site Locations

Figure 2
PM-10 Air Pollution Monitoring Network
Site Locations

Figure 3
PM-2.5 Air Pollution Monitoring Network
Site Locations

Figure 4
Air Toxics Monitoring Network
Site Locations

Figure 5 Trends in Rhode Island Ozone Concentrations

NAAQS = 75 ppb (8-hour average)

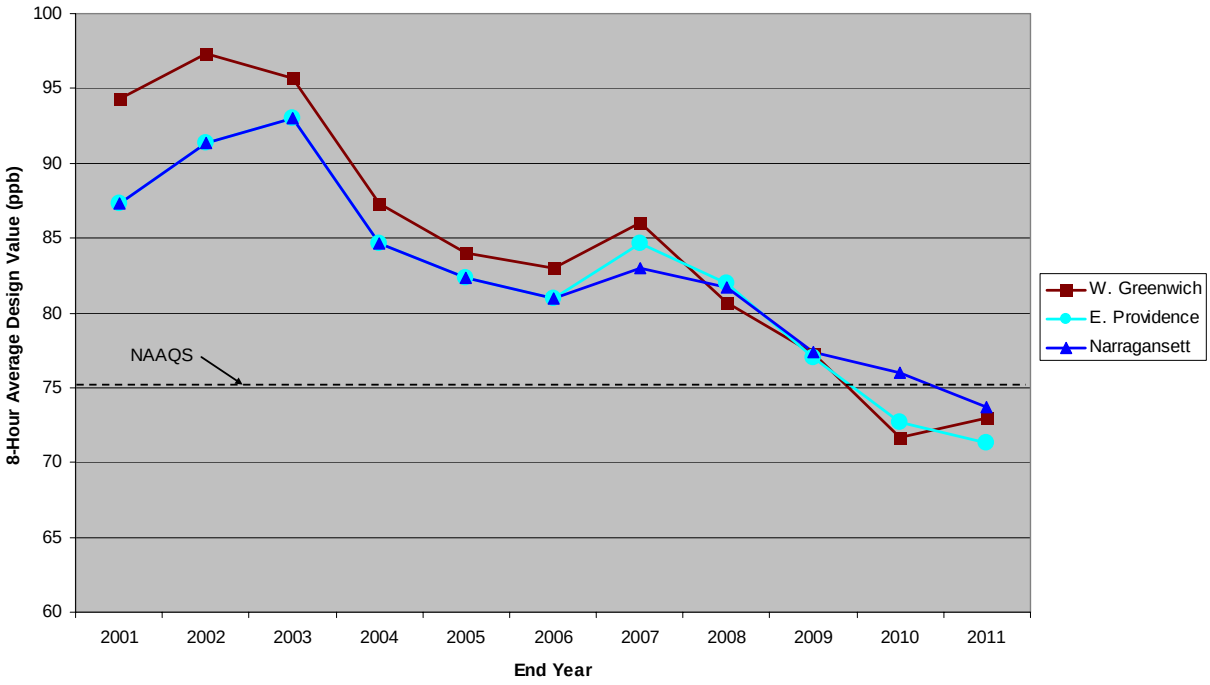


Figure 6 Trends in Carbon Monoxide Levels (8-Hour Average)
NAAQS = 9 ppm

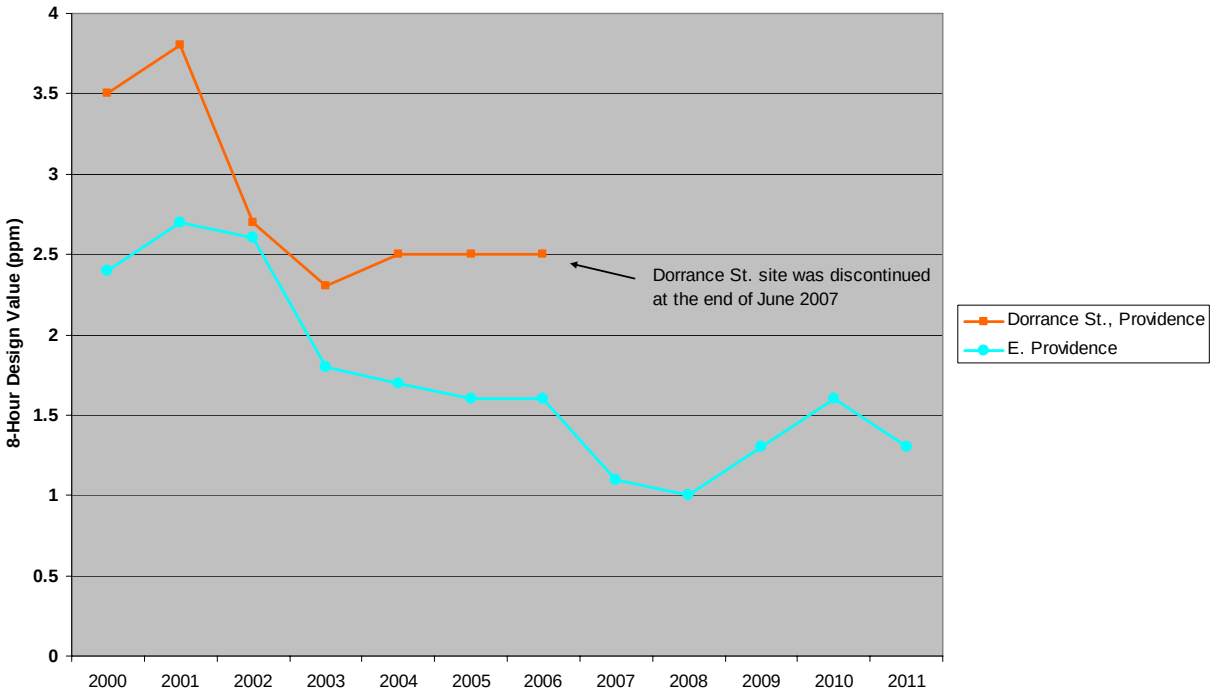
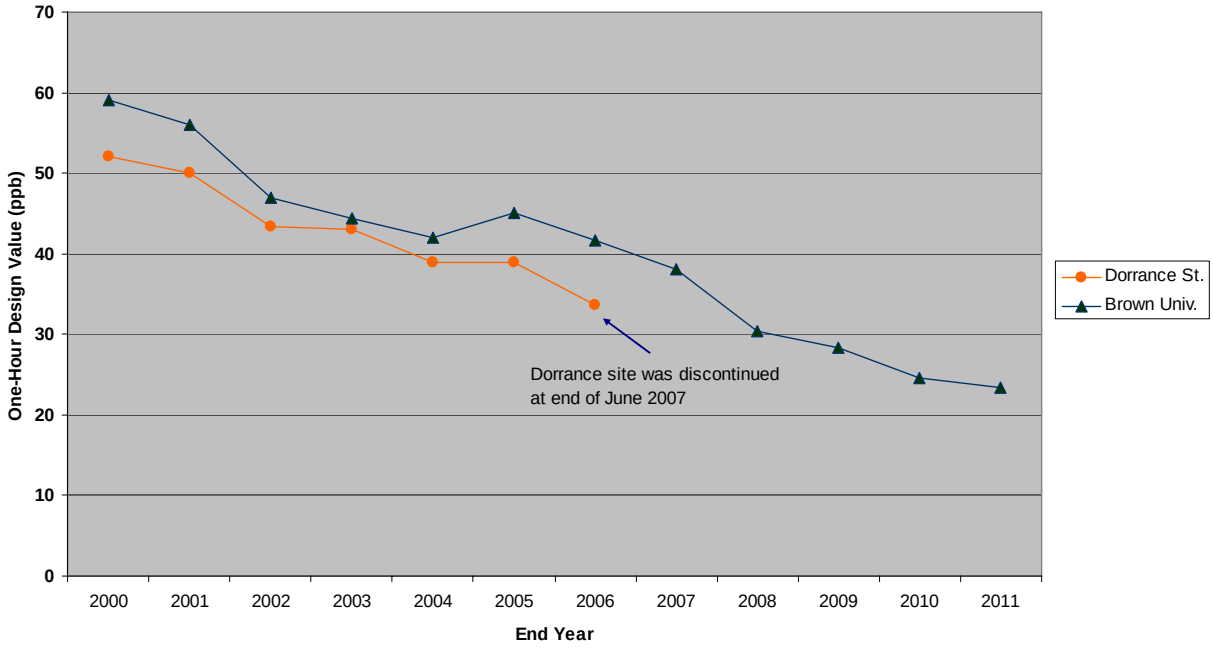


Figure 7 Trends in Sulfur Dioxide (SO_2) One-Hour Average Levels

NAAQS = 75 ppb



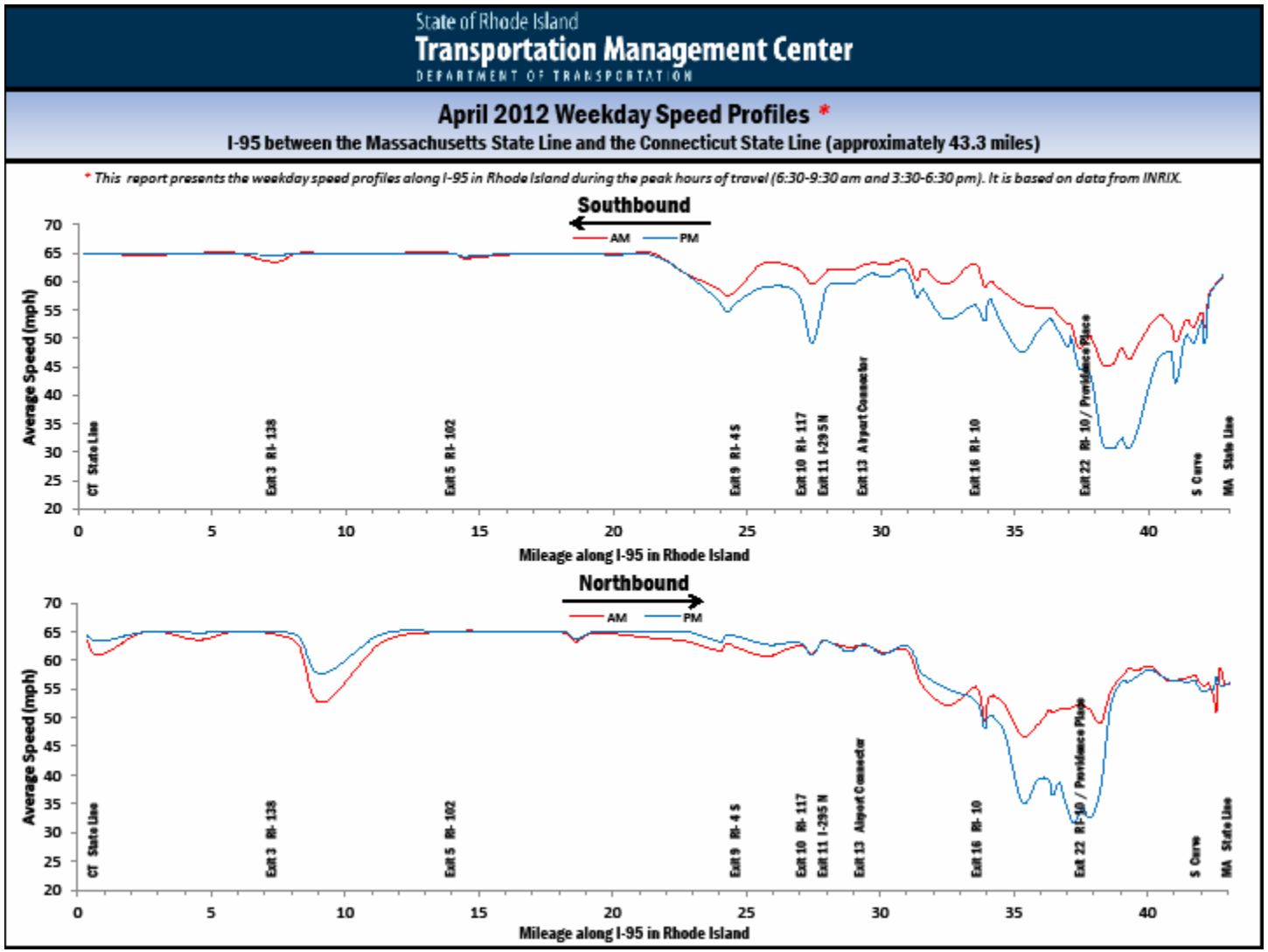


Figure 8 I-95 Congestion

Figure 9 Wind Direction Distribution at Urban League, Providence Site 2008-2010

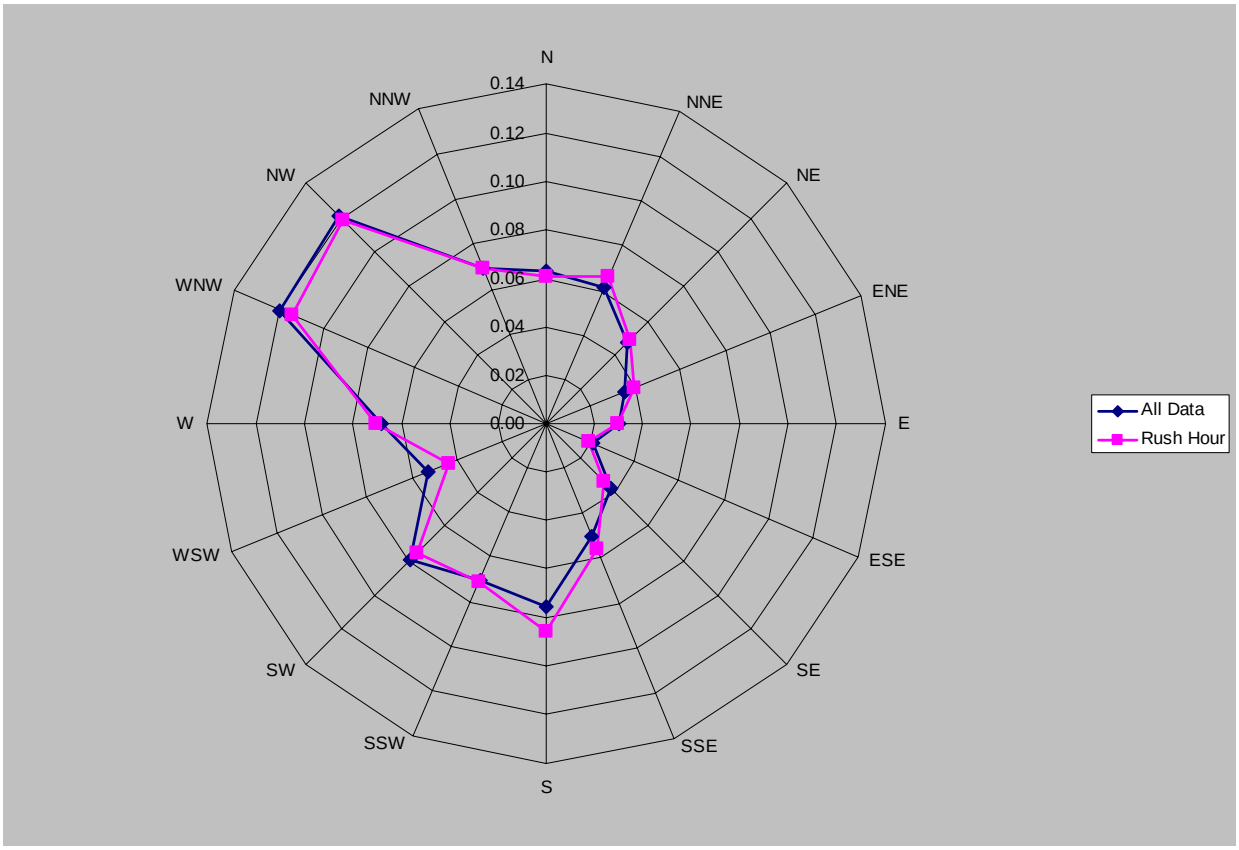


Figure 10 Wind Direction Distribution in Warmer and Cooler Months
at Urban League, Providence Site 2008-2010

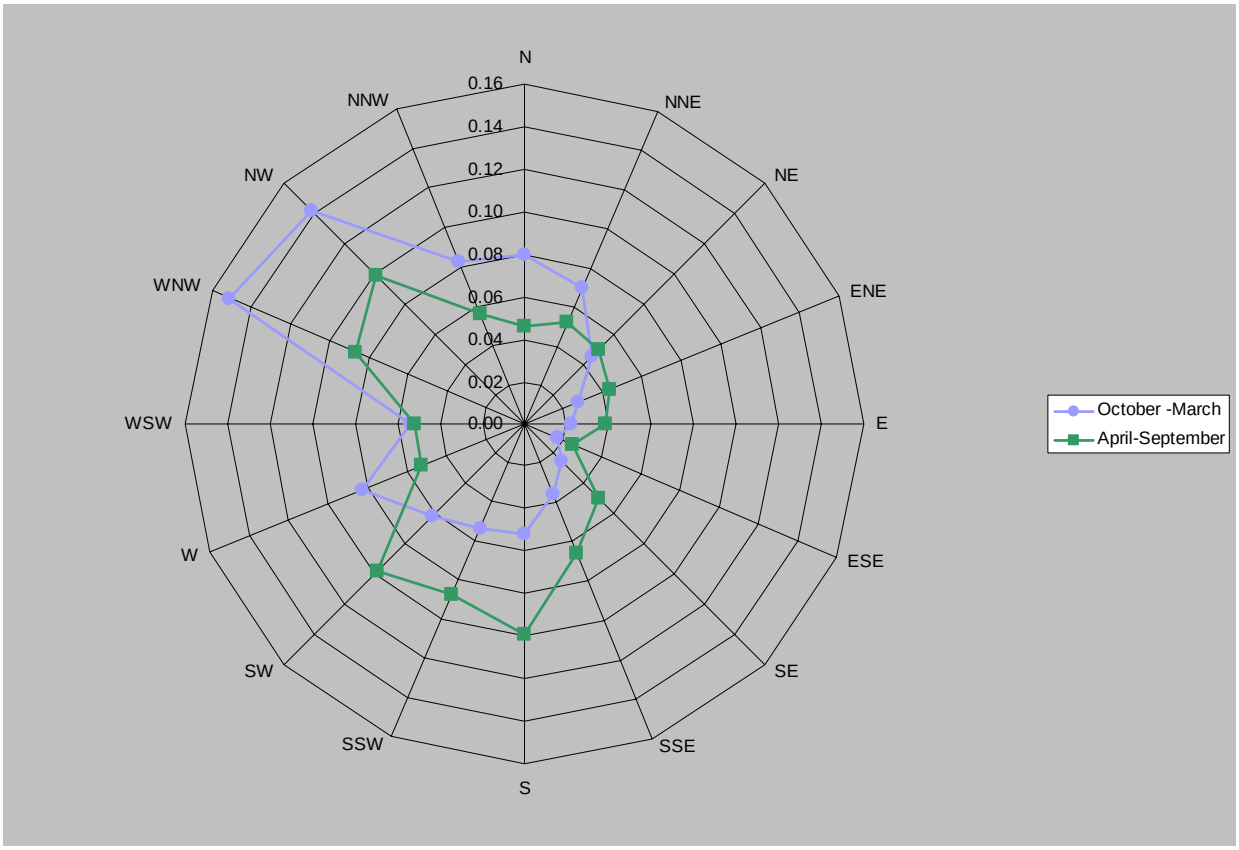


Figure 11 Hours with Wind Directions with Easterly and Westerly Components
Urban League, Providence Site, 2008-2010

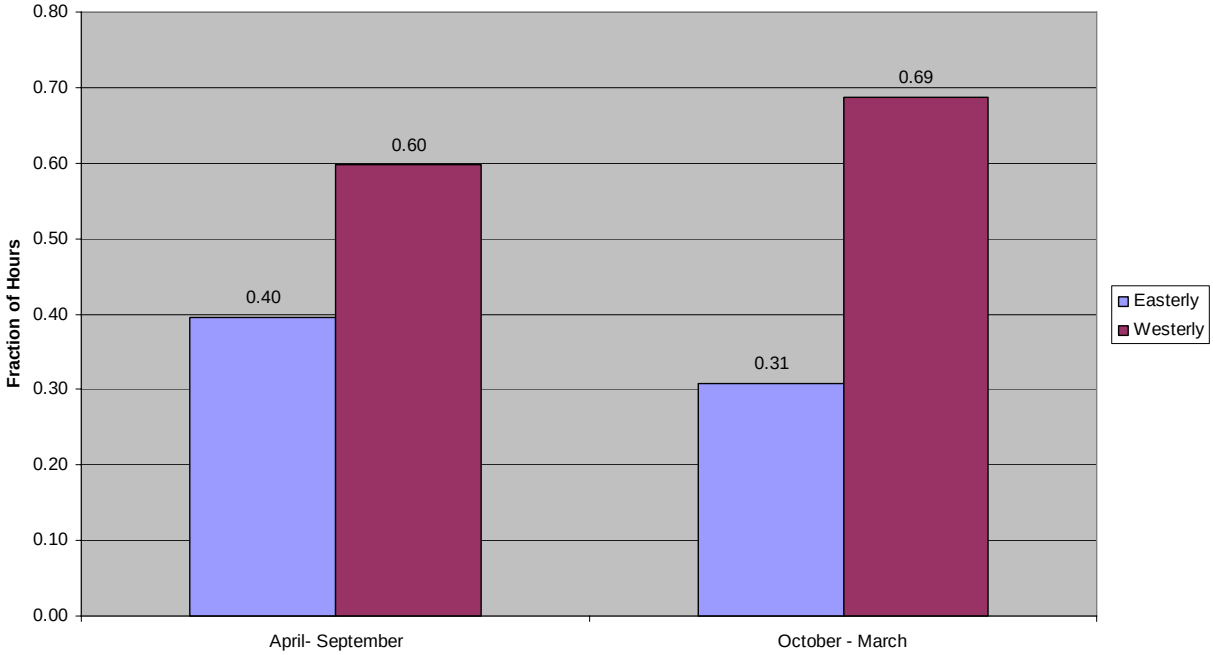


Figure 12 Trends in 24-Hour Average PM-10 Levels
NAAQS = 150 ug/m3

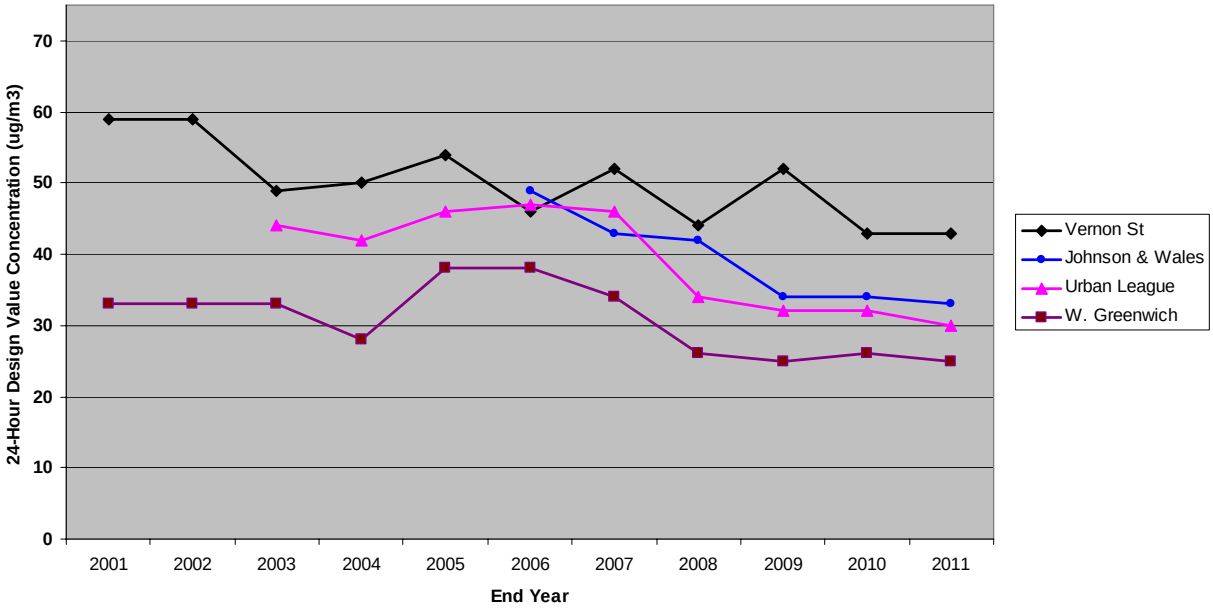


Figure 13 Trends in 24-Hour Average PM-2.5 Levels

NAAQS = 35 ug/m3

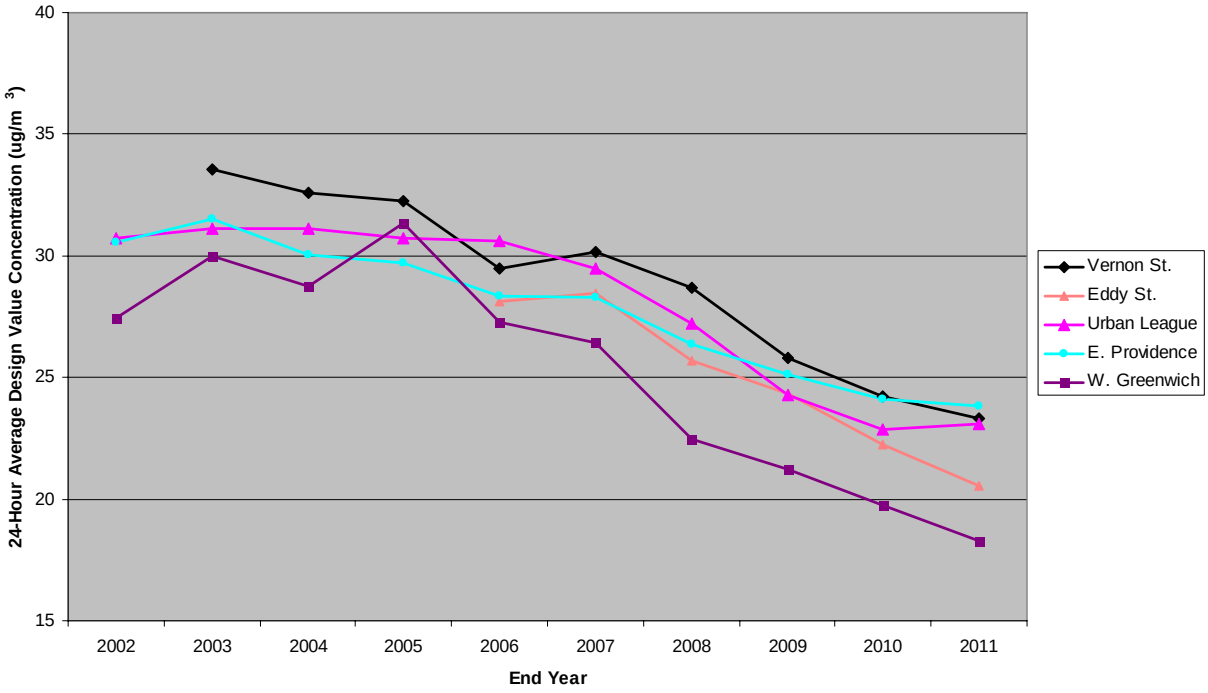


Figure 14 Trends in Annual Average PM-2.5 Concentrations

NAAQS = 15 ug/m^3