

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

Rhode Island 2016 Annual Monitoring Network Plan



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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 2016 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 (O₃), particulate matter smaller than 10 microns (PM₁₀), particulate matter smaller than 2.5 microns (PM_{2.5}), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), 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, one that is 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 that operated in the State in 2015 or are currently operating, 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 1 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- 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 and NCore Parameters, Revision 10.0," approved by EPA December 5, 2012 and "QAPP: Air Toxics and PAMS Monitoring Programs, Revision 4.1," approved by EPA December 5, 2012.

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/m ³) |
| | 1-Hour ^B | 0.075 ppm (75 ppb) | None |
| Carbon Monoxide (CO) | 8-Hour ^A | 9 ppm | None |
| | 1-Hour ^A | 35 ppm | None |
| Ozone (O ₃) | 8-Hour ^C | 0.070 ppm (70 ppb) | Same as Primary Standard |
| Nitrogen Dioxide (NO ₂) | Annual Arithmetic Mean | 0.053 ppm (53 ppb) | Same as Primary Standard |
| | 1-Hour ^D | 100 ppb | None |
| Particulate Matter ≤ 10 micrometers (PM ₁₀) | 24-Hour ^E | 150 µg/m ³ | Same as Primary Standard |
| Particulate Matter ≤ 2.5 micrometers (PM _{2.5}) | Annual Arithmetic Mean ^F | 12.0 µg/m ³ | 15.0 µg/m ³ |
| | 24-Hour ^G | 35 µg/m ³ | Same as Primary Standard |
| Lead (Pb) | Rolling 3-Month Average ^H | 0.15 µg/m ³ | 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.

^ANot to be exceeded more than once a year.

^B A rule revoking the annual and 24-hour SO₂ NAAQS and promulgating a new 1-hour SO₂ 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 SO₂ 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 0.070 ppm (70 ppb). The 0.070 ppm NAAQS became effective December 28, 2015.

^D To attain the 1-hour NO₂ NAAQS, effective January 22, 2010, the 3-year average of the 98th percentile of the daily maximum 1-hour average NO₂ concentration at each monitor must not exceed 100 ppb.

^E To attain the PM₁₀ 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 The primary annual average PM_{2.5} NAAQS was revised on December 10, 2012. The secondary NAAQS was not changed. 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 the NAAQS value.

^G To attain the PM_{2.5} 24-hour standard, the 3-year average of the 98th percentile of 24-hour concentrations must not exceed 35 µg/m³.

^HOn October 15, 2008, the Pb NAAQS was changed to 0.15 µg/m³ as a rolling 3-month average, not to be exceeded in a 3-year period.

µg/m³ = micrograms per cubic meter

mg/m³ = 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 |
| Brown University 10 Prospect Street Providence | 440070012 | 41.825556 -71.405278 | Oxides of Nitrogen | Chemiluminescence (low range) | Reference |
| | | | Nitrogen Dioxide | | |
| | | | Sulfur dioxide | Pulsed Fluorescence (low range) | Equivalent |
| USEPA Laboratory 27 Tarzwell Drive Narragansett | 440090007 | 41.4950779 -71.4236587 | Ozone | U.V. Photometric | Reference |
| | | | PM _{2.5} | Beta Attenuation/Cont | Equivalent |
| | | | 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 (low range) | Reference |
| | | | Nitrogen Dioxide | | |
| | | | 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 |
| | | | 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 | Equivalent |
| | | | PM ₁₀ | Lo Vol | N/A |
| | | | PM ₁₀ /Metals | Hi Vol | Reference |
| | | | 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 | | | |
| Near-Road Site Hayes and Park Sts. Providence | 440070030 | 41.829495 -71.417457 | Oxides of Nitrogen | Chemiluminescence (low range) | Reference |
| | | | Nitrogen Dioxide | | |
| | | | Carbon Monoxide | Gas Filter Correlation (low range) | Equivalent |
| | | | PM _{2.5} | Beta Attenuation/Cont | Equivalent |
| | | | Black Carbon | Aethalometer | 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 (O₃)

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 | SCHEDULE |
|--|-------------------------------|--|---|
| Alton Jones Campus Victory Highway West Greenwich | Regional | Upwind background Population exposure | Continuous Ozone Season March-September |
| USEPA Laboratory 27 Tarzwell Drive Narragansett | Regional | Population exposure | Continuous Ozone Season March-September |
| Francis School 64 Bourne Avenue E. Providence | Neighborhood (PAMS, NCore) | Maximum precursor emissions impact Population exposure | Continuous Year-Round |

The NAAQS for ozone is 70 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 70 ppb.

Ozone design values for all of the Rhode Island sites have decreased over time, but design values increased or remained constant in 2012 and 2013, as shown in Table 4. Based on 2009-2011 design values, EPA designated Rhode Island as unclassifiable/attainment for the 75 ppb NAAQS on April 30, 2012. Note, however, that the 2009-2011 design values were lower than normal, due to unusually cool temperatures in the summer of 2009. In the most recent three year period, 2013-2015, the design values for both the West Greenwich and the E. Providence sites met the 70 ppb NAAQS, while the design value for the Narragansett site was slightly higher than that standard.

Table 4 Ozone Design Values (ppb)

| | W. Greenwich | Narragansett | E. Providence |
|-------------|--------------|--------------|---------------|
| 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 |
| 2010 - 2012 | 74 | 78 | 75 |
| 2011 - 2013 | 74 | 78 | 76 |
| 2012 -2014 | 70 | 74 | 73 |
| 2013 - 2015 | 70 | 73 | 70 |

Since EPA’s rules require Rhode Island to operate at least two ozone monitors, the State has one more monitor than the minimum number required. Continued operation of all of the current monitors is important for the following reasons:

- Ground-level ozone levels have generally decreased in the past several years; however, ozone concentrations in the State continue to reach unhealthy levels on several days each summer. Note that 8-hour average ozone levels were above 75 ppb at one or more of the Rhode Island monitoring sites on 7 days in 2013. In 2015, there were 10 days with levels above 70 ppb and 31 days with levels above 60 ppb.
- EPA has strengthened the ozone NAAQS to 70 ppb to protect public health effective December 28, 2015.
- 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.

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. Although the final 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 West Greenwich sites have been 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.

RI DEM plans on changing the monitoring season at Narragansett and West Greenwich to reflect the EPA monitoring requirements of March to September due to the 2015 ozone NAAQS beginning in 2017. No other changes to the ozone monitoring network are planned for the next 18 months.

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 | SCHEDULE |
|--|-------------------|---|--------------------------|
| Francis School 64 Bourne Avenue E. Providence | Neighborhood | Maximum precursor emissions impact Population exposure | Continuous Year-Round |
| Near-Road Site Hayes and Park Sts. Providence | Microscale | Maximum emissions Near-road (began operation in April 2014) | Continuous Year-Round |

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 at the East Providence site in the last five years (2011 - 2015) occurred in 2013 are:

- 2.0 ppm – 1 hour average, 5.7% of NAAQS,
- 1.3 ppm – 8-hour average, 14.4% of NAAQS

The 2015 CO design values for Rhode Island are:

Near Road:

- 3.5 ppm – 1 hour average, 10% of NAAQS
- 1.8 ppm – 8 hour average, 20% of NAAQS

Francis School:

- 1.8ppm – 1 hour average, 5% of NAAQS
- 1.0 ppm – 8 hour average, 11% 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” category of the EPA’s Air Quality Index (AQI).

EPA’s regulations do not specify a minimum number of CO monitors that must be operated in a state, except that CO monitoring is required at NCore sites (40 CFR 58, Appendix D 3(b)). Since the East Providence site is both a 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.

On August 21, 2011, EPA issued a decision retaining the CO NAAQS at the current levels.² The decision requires the operation of CO monitors at sites established to comply with the near-road monitoring requirements specified in the 2010 NO₂ NAAQS. Near-road sites are required in 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 began operating a low-range CO monitor at a site adjacent to Interstate Route 95 that meets the above near-road specifications in April 2014.

No changes to the CO monitoring network are planned in the next 18 months.

Sulfur Dioxide (SO₂)

The current SO₂ monitoring network is as shown in Table 6:

Table 6 Sulfur 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 | NCore | Continuous Year-Round |

² US EPA, “Review of National Ambient Air Quality Standards of Carbon Monoxide: Final Rule,” Federal Register 76 (169):54294, August 31, 2011. <http://www.gpo.gov/fdsys/pkg/FR-2011-08-31/pdf/2011-21359.pdf>

The NAAQS for SO₂³ 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 SO₂ design values recorded in the last three years (2013 – 2015) in Rhode Island are:

- 15 ppb - 1 hour average, 20% of primary NAAQS (occurring in 2013 - Brown monitor)
- 19 ppb – 1 hour average, 25% of primary NAAQS(occurring in 2013 – East Providence monitor)

The SO₂ NAAQS has never been exceeded in the State. One-hour design values for SO₂ 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. SO₂ levels measured at the Brown University monitor in Providence declined dramatically in 2013, probably due to the increased use of natural gas rather than fuel oil by nearby sources.

EPA’s 2006 amended monitoring regulation requires SO₂ monitoring only at NCore sites. However, the 2010 SO₂ NAAQS rule requires at least one SO₂ monitor in the Providence-New Bedford-Fall River RI, MA MSA, which includes all of Rhode Island and Bristol County, Massachusetts. That SO₂ 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 SO₂ monitor at Brown University in Providence and, to meet NCore requirements, began operating a low-range SO₂ monitor at the East Providence site in January 2011. The Brown University SO₂ monitor was updated to a low-range unit in January 2013. RI DEM believes that the Brown University and East Providence monitors appropriately characterize population exposure in the major urban areas in Rhode Island.

The State of Massachusetts also operates a SO₂ monitor in the Providence Warwick RI-MA MSA. Since that monitor is located in Fall River, MA, approximately two miles southeast of the Brayton Point coal-fired power plant, the SO₂ levels recorded at that site have historically been

³ An EPA rule amending the SO₂ 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.

substantially higher than those at the Rhode Island sites; however, SO₂ levels recorded at that site dropped in 2014, probably due to the decreased operation of the power plant. The 2014 one-hour design value for SO₂ at the Fall River monitor was 47 ppb, 63% of the NAAQS and more than three times the highest Rhode Island design value. According to EPA's Emissions Inventory System (EIS), in 2011 the Brayton Point facility emitted 18,648 tons of SO₂, 50 times more than the highest emitting Rhode Island source, Central Landfill (352 tons). Therefore, the Fall River monitor is more appropriate than a Rhode Island location for characterizing maximum concentrations in the MSA. RI DEM will reevaluate the placement of the maximum concentration monitor subsequent to the closure of the Brayton Point plant, which is scheduled for the summer of 2017.

Given the above considerations, RI DEM does not plan any changes in the State's sulfur dioxide monitoring network in the next 18 months. However, depending upon financial consideration and priorities RIDEM may discontinue monitoring at the Brown University site. Note that, since low-range SO₂ monitors are now in use at both the East Providence and Brown University sites, RI DEM does not plan to further update the technology used for measuring that pollutant at this time.

Nitrogen Dioxide (NO₂)

The current NO₂ monitoring network is shown in Table 7a:

Table 7a 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 Year-Round |
| Alton Jones Campus Victory Highway West Greenwich | Regional | Population exposure Upwind background | Continuous Ozone season |
| Near-Road Site Hayes and Park Sts. Providence | Microscale | Maximum emissions Near-road | Continuous Year-Round |

In January 2013, NO₂ monitors at all sites were replaced with low-range units with the exception of Brown University.

The NO₂ NAAQS are:

- 100 ppb - 1 hour average (effective January 22, 2010). The design value is the average of the 98th percentile maximum daily hour measured in 3 consecutive years.
- 0.053 ppm (53 ppb) - annual average

The highest NO₂ design values recorded in the last five years are:

- 46 ppb - 1 hour average, 46% of NAAQS
- 11 ppb - annual average, 21% of NAAQS

Design values for 2015 are:

- 46 ppb - 1 hour average, 46% of NAAQS
- 22 ppb annual average, 42% of NAAQS

The NO₂ NAAQS have never been exceeded in Rhode Island. Since there was no short-term NAAQS for NO₂ until the standard was amended in 2010, this pollutant was not used for the Air

Quality Index (AQI) before that date. The amended NO₂ NAAQS rule, which was published on February 9, 2010⁴, establishes hourly levels of 54 -100 ppb as the range for a “Moderate” AQI. In the 5 year period of 2011– 2015, there were a total of 4 days when NO₂ 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 NO₂ NAAQS requires Rhode Island to operate two NO₂ monitoring sites, one at “a location of expected highest NO₂ concentrations representing the neighborhood or larger spatial scales” and a second monitor at a near-road location where maximum microscale-representative concentrations are expected, Rhode Island intends to use the current NO₂/NO_x site at Brown University in Providence to fulfill the requirement for a neighborhood scale site. NO₂/NO_x monitoring has been conducted at that site, which has been approved as neighborhood scale representative, since 1994; therefore, the data collected at that site can be used to track trends in NO₂/NO_x concentrations over time. Moreover, the site is in the area of the State with the largest NO₂/NO_x emitting sources and the highest density of NO₂/NO_x emissions. NO₂ concentrations measured at the Brown University site are substantially lower than the NAAQS for that pollutant, including the 1-hour average standard.

After an evaluation of meteorology, traffic counts, diesel traffic and congestion, RI DEM and EPA agreed to locate the Rhode Island near-road site on the east side of the Interstate Route 95 near downtown Providence. Monitoring for NO₂/NO_x, as well as CO, PM_{2.5} and black carbon, began at that site in April 2014. It should be noted that the Rhode Island Department of Transportation is currently engaged in a large scale highway reconstruction/bridge repair project on the southbound side of I-95, just southwest of the monitoring site, and emissions from construction equipment and activities may have a measureable impact on monitored levels at the near-road site. In addition, construction is due to shift to the northbound lanes in two or three years, at which time the monitoring site will need to be relocated.

To fulfill PAMS requirements, NO₂/NO_x is also monitored at the East Providence year-round. Although not required under the new regulations West Greenwich is monitored during the ozone season. To determine how NO₂/NO_x levels at the East Providence site compare to those measured at the Brown University site, Rhode Island has operated the East Providence monitor continuously since March 2012. In 2015, the one hour and annual average concentrations were considerably lower at that site than at the Brown site, as shown in Table 7b.

⁴ 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>

Table 7b 2013 Nitrogen Dioxide Levels at Brown and East Providence Sites (ppb)

| Site | Year | 98th Percentile One-Hour | Annual Average |
|------------------------------|-------------|--|-----------------------|
| Brown Univ., Providence | 2015 | 52 | 11 |
| Francis School, E Providence | 2015 | 42 | 8 |

Therefore, it does not appear that operation of the East Providence monitor year-round has affected Rhode Island's NO₂ design values. However, NO₂ levels were higher at the East Providence site than at the Brown University sites on some days. Given the above considerations, RI DEM may make changes in the State's nitrogen dioxide monitoring network in the next 18 months. Since low-range NO₂ monitors are currently in use at the East Providence, and Near-Road sites, RI DEM does not plan to further update the technology used for measuring that pollutant at this time. A low-range monitor that measures NO and NO_y (total reactive nitrogen oxides) has also been operated at the East Providence site since January 2011, consistent with the NCore requirements. Under the circumstances RIDEM may consider terminating the site located at Brown University in the future.

Particulate Matter

Particles smaller than 10 microns (PM₁₀)

The current PM₁₀ monitoring network is as shown in Table 8 and Figure 2:

Table 8 PM₁₀ 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 Co-located 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 (discontinued 6/30/16) and PM _{10-2.5}) | 24-hour 1 in 6 day (pb) 1 in 3 (PM _{10-2.5}) |

The PM₁₀ NAAQS is:

- 150 µg/m³ – 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 PM₁₀ value recorded in Rhode Island in the last five years is:

- 70 µg/m³ – 24-hour average, 46% of NAAQS, recorded at Vernon St. in 2013

The highest value for PM₁₀ recorded at a Rhode Island site for 2015 is:

- 42 µg/m³ – 24-hour average, 28% of NAAQS, recorded at Vernon St.

The PM₁₀ NAAQS has never been exceeded in Rhode Island. Since PM₁₀ is measured using a filter-based method, results are not immediately available and cannot be used for Air Quality Index calculations. 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 West Greenwich site. PM₁₀ levels appear to have slightly decreased over the past decade.

Since late 2011, PM₁₀ has also been measured at the East Providence NCore site every sixth day using a lo-vol sampler. Those PM₁₀ measurements are used, in conjunction with PM_{2.5} measurements at that site, for calculating PM_{10-2.5} levels. The lo-vol PM₁₀ filters were 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 PM₁₀ concentrations below 80% of the NAAQS, to operate a minimum of 2-4 PM₁₀ 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.

As discussed above, PM₁₀ measurements at the East Providence site are used for calculating PM_{10-2.5} levels and, since this measurement is required at NCore sites, PM₁₀ sampling cannot be discontinued at that site. Similarly, PM₁₀ samples collected at the Urban League site in Providence are analyzed for metals to fulfill NATTS requirements, so PM₁₀ sampling at that location cannot be discontinued. The rural Alton Jones, West Greenwich site provides useful information about background concentrations of PM₁₀ in Rhode Island. The Vernon St., Pawtucket site, which is adjacent to I-95, tends to record the highest PM₁₀ concentrations in the State.

The Johnson & Wales site is approximately one mile from the Urban League location. The PM₁₀ levels at the Johnson & Wales site correlate well with those at the Urban League ($r^2 = 0.81$). At this time, we are requesting to modify the State's PM₁₀ network and discontinue operation of the Johnson & Wales site as soon as possible but no later than December 31, 2016. We may consider discontinuation of the Alton Jones site in the future if warranted due to budgetary constraints and will seek EPA approval. RI DEM plans to continue to operate the Alton Jones site for the present time.

RI DEM is planning to modify the State's PM₁₀ network in the next 18 months. Since four of the five PM₁₀ monitors currently operating in the State are located in the Providence metropolitan area and one of those monitors is near a major roadway, the current PM₁₀ measurements adequately characterize exposure of the sensitive populations in urban areas to that pollutant. There are no immediate plans to use new technology for measuring PM₁₀ in Rhode Island. RIDEM is requesting to discontinue monitoring at the Johnson and Wales site and may consider modifying the Alton Jones site in the future.

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

The 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} Monitoring Network

| SITE | MEASUREMENT SCALE | MONITORING OBJECTIVE | SCHEDULE |
|--|--------------------------|---|---|
| Vernon Trailer Vernon Street Pawtucket | Middle | Population exposure | 24-hour, 1 in 3 day |
| Urban League 212 Prairie Avenue Providence | Neighborhood | Population exposure Highest concentration | 24-hour, daily 1 in 6 day co-located sampler Continuous FEM |
| Francis School 64 Bourne Avenue E. Providence | Urban | Population exposure Highest concentration | 24-hour, daily Continuous FEM |
| Alton Jones Campus Victory Highway West Greenwich | Regional | Population exposure General/Background Regional Transport | Continuous FEM 1 in 6 day co-located sampler |
| USEPA Laboratory 27 Tarzwell Drive Narragansett | Regional | Population exposure | Continuous FEM |
| Near Road Site Hayes and Park Sts. Providence | Microscale | Near-road | Continuous FEM |

Filter-based FRM PM_{2.5} units are operated as the primary samplers at the Vernon, Urban League and East Providence sites and FEM continuous PM_{2.5} monitors are used as the primary samplers at the West Greenwich, Narragansett and, as of April 2014, the near-road site in Providence. Continuous PM_{2.5} FEM monitors are operated at the Urban League site and the East Providence NCore site as secondary monitors; data recorded by those monitors are used as substitute measurements on days when valid data from the primary samplers at those locations are not available. Before 2013, continuous PM_{2.5} data collected at the Narragansett site were not used in determinations of compliance with the NAAQS for that pollutant but, since the monitor at that site has been upgraded to a FEM unit, those data are now suitable for regulatory purposes. Co-located filter-based FRM samplers are operated at the Urban League and East Providence sites 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 resumed in July 2012. Monitoring at a site on Eddy Street, Providence site was discontinued at the end of 2012.

The PM_{2.5} NAAQS are:

- 35 µg/m³ – 24-hour average (design value is the 3-year average of the 98th percentile 24-hour concentration)
- 12 µg/m³ - 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)⁵

The highest PM_{2.5} values for 2015 are:

- 22.7 µg/m³ – 24-hour average, 65% of NAAQS, recorded at Near Road.
- 9.8µg/m³ – annual average, 82% of NAAQS, recorded at Near Road.

Annual average levels are consistently highest at the Vernon Street site, which is adjacent to I-95, and higher at the East Providence and the two Providence sites than at the rural West Greenwich site. PM_{2.5} levels have decreased over the past decade, although the additional data obtained from the New Road site is higher than other sites, no conclusion can be made as to whether the levels have decreased over the past decade.

Although none of the monitors violate the NAAQS (including the revised annual average NAAQS), PM_{2.5} levels at one or more sites in the State were at or above 35 µg/m³ and, therefore, the air quality was unhealthy, on four days in the past five years (2011 – 2015). Note also that many members of the scientific community have recommended that the 24-hour PM_{2.5} NAAQS be reduced to a level of 30 µg/m³ or less to be protective of public health. In the 2011-2015 period, there were 11 days with concentrations at or above that level 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}.

Although Rhode Island operates more PM_{2.5} sites than required, each site fulfills a specific information need or EPA requirement. The West Greenwich site fulfills EPA's requirements for measurement of background and regional transport concentrations of PM_{2.5}. The 24-hour and

⁵ In December 2012, EPA revised the PM NAAQS, reducing the annual average PM_{2.5} NAAQS from 15 to 12 µg/m³. The rule left the PM₁₀ NAAQS and the 24-hour average PM_{2.5} NAAQS and the secondary annual average PM_{2.5} NAAQS unchanged.

annual PM_{2.5} design values for the Vernon Street, Pawtucket site, which is immediately adjacent to Interstate Rte. 95, tend to be higher than those at the other sites, so that is a maximum impact site. The East Providence monitor cannot be removed because PM_{2.5} monitoring is required at NCore sites, and the Urban League and Narragansett monitors fulfill the need for air quality data for urban and coastal areas of the State, respectively. Note that another Providence PM_{2.5} site, the Eddy Street monitor, was discontinued at the end of 2012.

As discussed above, PM_{2.5} monitoring at the Rhode Island near-road site began in April 2014 and will continue until such time that the site is no longer tenable, due to the progression of construction activity in the area. Note also that the long-term future of the Urban League building is questionable as the building is for sale, therefore arrangements are being made to move the site to an alternative location. RI DEM will request approval from the EPA of alternative locations for these sites if moves are required. The alternative location identified is the Community College of Rhode Island, which may have difficulty in accommodating all of the equipment, therefore the PM_{2.5} from that location will be moved to Vernon Street.

RI DEM is changing the FEM at the E. Providence site to be the primary PM_{2.5} monitor at that site and use the FEM and FRM data from that site to evaluate FEM-FRM comparability at Rhode Island sites. The advantages of using the East Providence, rather than the West Greenwich site for this purpose include:

- PM_{2.5} levels at the East Providence site, although still substantially below the NAAQS, tend to be higher than those at the West Greenwich site. For the period 2012 through the first quarter of 2015, 11% of the FRM measurements at the W. Greenwich site were 10 µg/m³ or above, while 22% of the FRM measurements at the E. Providence site were in that range.
- Since the East Providence FRM runs every day, it generates six times as much comparison data as are generated at W. Greenwich.
- As historical data has demonstrated, the E. Providence FEM and FRM measurements tend to be better correlated and to have less bias than is observed at the W. Greenwich site.

Operation of the Near-Road site will be disrupted at some future date, due to the progression of construction activity in the area. RI DEM will notify EPA when it receives notice of that disruption to discuss future plans for near-road monitoring in the State. RIDEM will be changing the current PM_{2.5} FRM sampling frequency from every day, to 1-in-3 at Francis School and Urban League beginning October 1, 2016. As of January 1, 2017 RIDEM will be moving the collocated FRM monitor from the Urban League site to Vernon Street. Depending on staffing needs and budgetary considerations RIDEM may also consider discontinuing using the FRMs at the both Urban League or its new location, or Alton Jones. No other changes to the PM_{2.5} network are anticipated in the next 18 months.

Speciation Monitoring

The EPA's PM_{2.5} Speciation Trends Network (STN) is designed to characterize metal, ion and carbon constituents of PM_{2.5}. RI DEM began operating PM_{2.5} speciation monitors at the Urban League and East Providence sites as a part of that network on a one in six-day schedule in June 2002. Operation of the East Providence speciation equipment was discontinued in May 2004 and, at that time, the monitoring frequency at the Urban League speciation site was increased to one in three days. In November 2008, the speciation equipment at the Urban League was replaced by a SASS speciation unit and, in March 2009, an URG carbon sampler began operation at that location as part of the speciation program. To conform to NCore requirements, the speciation equipment, including the carbon sampler, was moved to the East Providence NCore site in January 2011 and is now being operated there on a one-in-three day schedule. Speciation filters are analyzed by an EPA contractor.

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 standard. To determine whether an area is in compliance with the new standard, the rule requires two types of lead monitoring: source-specific monitoring in the vicinity of lead sources that emit 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 to be analyzed for lead at the East Providence NCore site in June 2011. As specified in the lead NAAQS rule, sampling is conducted on a one-in-six day schedule.

The current lead (Pb) monitoring network is as shown in Table 10:

Table 10 Lead Monitoring Network

| SITE | MEASUREMENT SCALE | MONITORING OBJECTIVE | SCHEDULE |
|--|--------------------------|---|---|
| Francis School 64 Bourne Avenue E. Providence | Neighborhood | Population exposure (area-wide) (NCore) | 1 in 6 day Discontinued 6/30/2016 |

- The NAAQS for Pb is 0.15 µg/m³, as a rolling three month average, measured in total suspended particulate matter (TSP)

Rhode Island measures Pb in PM₁₀, not in TSP. In the lead NAAQS rule, EPA allows states to

use Pb- PM₁₀ monitoring, without a scaling factor, as a surrogate for Pb-TSP NAAQS monitoring at area-wide monitoring sites, as long as the 3-month average Pb- PM₁₀ concentrations at those sites remain below 0.10 µg/m³. Note that the highest 3-month average PM₁₀ concentration that has been measured at the East Providence site is approximately 7% of that trigger level.

Rhode Island's lead filters were analyzed by the State of Maine using EPA-approved XRF methodology. As specified in the lead NAAQS rule, sampling was conducted on a one-in-six day schedule. EPA deleted the requirement to monitor for non-source Pb at NCore sites from Appendix D of 40 CFR part 58.16 and to allow monitoring agencies to request permission to discontinue non-source monitoring following the collection of at least 3 years of data at urban NCore sites. Since ambient lead monitoring has been conducted in the State for more than 3 years and the lead levels have been consistently considerably lower than the NAAQS since the inception of monitoring, RI DEM had asked for and received permission to discontinue monitoring as of June 30, 2016. Monitoring has been discontinued.

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 and ozone precursors and to evaluate the spatial and diurnal variability of those pollutants in order 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 identified 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, were 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 was required in the State. The Alton Jones monitoring site in West Greenwich was designated as the State's Type 1 PAMS site and the East Providence site as the Type 2 PAMS site. In addition, the Massachusetts Department of Environmental Protection (MA DEP) operated a site at the Blue Hills Observatory in Milton, Massachusetts (Site ID 25-021-3003) that served as the Type 1 (upwind) site for the Boston area and as the Type 3 (downwind) site for the Providence area.

The following PAMS pollutants have been monitored in the Rhode Island network:

- 24-hour speciated VOC samples have been collected every sixth day year round at the Type 1 and Type 2 sites, VOC samples collected daily during June, July and August at the Type 2 site. As of June, July and August of 2017 hourly VOC samples will be collected at East Providence site using an Auto-GC.
- 24-hour carbonyl samples have been collected every sixth day year round at the East Providence Type 2 site. Eight 3-hour carbonyl samples per day were collected every third day during June, July and August through 2011 at that site. Note that 3-hour carbonyl samples were 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 did not apply to the State.
- In 2015, NO_x was measured continuously March through October at the Type 1 site in West Greenwich and year round at the Type 2 site in E. Providence and the MA DEP Type 3 site in Milton, MA.
- Rhode Island has measured reactive nitrogen oxides (NO_y) at the Type 2 site since 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 March through October at the West Greenwich and Narragansett sites and, since 2011, has been measured year-round at the Type 2 site in East Providence to fulfill NCore requirements. Ozone has also been measured year-round at the Milton, MA site since February 2013.

- Surface meteorological parameters are measured at all three Rhode Island sites and at the Milton, MA site 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.

The EPA promulgated a new NAAQS for ozone effective December 28, 2015. As a result, the following changes to the PAMS program have occurred as a result of the new regulations.

- The network design change involved EPA requiring PAMS measurements minimally during the PAMS (summer) sampling season, which is June 1 through August 31, at all NCore sites in Core-Based Statistical Areas (CBSAs) with a population of 1,000,000 people or more. Note that, since the Rhode Island Type 2 PAMS site is also the State's NCore site, this requirement would not necessitate a relocation of that site. The second part of the network design requires states with moderate or above non-attainment areas and states in the Ozone Transport Region (OTR) to develop and implement Enhanced Monitoring Plans (EMPs). These EMPs are intended to provide monitoring organizations with flexibility to implement additional monitoring to suit the needs of their area.
- It is strongly suggested that all required PAMS sites take hourly speciated VOC measurements with auto-gas chromatographs (GCs). There is a waiver option to allow three 8-hour samples every third day as an alternative to daily hourly speciated VOC measurements at locations where auto GCs may not be appropriate. RI DEM has purchased and will employ a continuous GC at the East Providence PAMS site for summer 2017.
- All required PAMS sites will conduct carbonyl sampling with a frequency of three 8-hour samples on a one-in-three day basis. Episodic carbonyl measurements are not a requirement for the required PAMS sites, but such could be included in an EMP as it would be useful for the individuals modeling the data. RI DEM will implement the carbonyl monitoring requirements.
- All required PAMS sites must monitor for NO and NO_y (total oxides of nitrogen) in addition to true NO₂, where the latter must be measured with a direct reading NO₂ analyzer, cavity attenuated phase shift (CAPS) spectroscopy analyzer, or photolytic-converter NO_x analyzer. Rhode Island installed a FRM low-range NO₂/NO_x analyzer at the East Providence site in 2013 and operates that analyzer year-round. EPA's preferences for a particular NO₂/NO_x monitoring technology will be considered when replacement of that equipment is necessary.
- All required PAMS sites must measure wind direction, wind speed, temperature, humidity, atmospheric pressure, precipitation, solar radiation, ultraviolet radiation and mixing height. Although EPA is suggesting the use of ceilometers for mixing height, other types of meteorological equipment that provide for an indication of mixing height can be proposed. A waiver to allow meteorological measurements to be obtained from other nearby sites, such as

National Oceanic and Atmospheric Administration Automated Surface Observing System sites. The required parameters are measured at the E. Providence site, and the location of mixing height measurements will be considered prior to the required implantation date.

As discussed above, Rhode Island has purchased and will employ a continuous GC for measuring one-hour average speciated VOCs at the East Providence PAMS site summer 2017. RI DEM will develop an Enhanced Monitoring Plan for implementing additional applicable PAMS requirements, including a possible expansion of the carbonyl monitoring program.

Air Toxics

Rhode Island operates one 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 neighborhood on the south side of Providence, approximately ½ mile west of I-95. This site was chosen as the State's NATTS site because it is not dominated by local sources and because levels of air toxics at this site appear to be representative of those in urban areas in the State. Note that, since the long-term future of the Urban League building is unknown at this time, RI DEM is working to identify nearby locations to which the NATTS site could be moved if necessary. RI DEM will request the EPA's approval of the new proposed location at CCRI if we succeed in obtaining the necessary agreements with CCRI

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
- Vinyl Chloride

Carbonyls

- Formaldehyde
- Acetaldehyde

Metals

- Nickel compounds (PM₁₀)
- Arsenic compounds (PM₁₀)
- Cadmium compounds (PM₁₀)
- Manganese compounds (PM₁₀)
- Beryllium (PM₁₀)
- Lead (PM₁₀)
- Hexavalent chromium (TSP) – Discontinued as of the end of June 2013 in accordance with changing EPA priorities.

Semi-Volatile Organic Compounds (SVOC)

- Benzo(a)pyrene
- Napthalene

VOC, carbonyls and PM₁₀ metal samples are analyzed by RI DOH. SVOC samples are analyzed by an EPA contractor. Note that, due to the redirection of EPA resources, monitoring for hexavalent chromium in Rhode Island was discontinued at the end of June 2013. 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 West Greenwich site, East Providence site, and at the Vernon Street site, which is adjacent to I-95 in Pawtucket. 24-hour carbonyl samples are collected at the East Providence site on the same schedule.

In addition, RI DEM /RI DOH operates aethalometers, which measure black carbon, an indicator of diesel exhaust, at the Urban League NATTS site and the East Providence PAMS/NCore site and, as of April 2014, at the near-road site in Providence.

RI DEM has discontinued its lead monitoring at the East Providence site as of 6/30/2016. In addition the Rhode Island NATTS site may be moved from the Urban League Building to the roof of the Community College of Rhode Island which is very close by as soon as negotiations are finalized. No other changes are planned for the ozone precursor or air toxics monitoring sites in the next 18 months.

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 EPA's 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 East Providence site is operating as the State's NCore site. Ozone, low-range NO₂/NO_x, reactive oxides of nitrogen (NO_y), low-range CO, low range SO₂, PM_{2.5} (FRM, continuous and speciated), coarse PM (PM_{10-2.5}), VOCs, carbonyls, black carbon, lo-vol PM₁₀ lead, and meteorological parameters are monitored at that site. PM_{10-2.5} is measured as the difference between lo-vol PM₁₀ and lo-vol PM_{2.5} concentrations. Note that the conventional NO₂/NO_x monitor at this site was replaced by a low-range NO₂/NO_x monitor in January 2013 and is being operated year-round. EPA deleted the requirement to monitor for non-source lead at NCore sites from Appendix D of 40 CFR part 58.16 and to allow monitoring agencies to request permission to discontinue non-source monitoring following the collection of at least 3 years of data at urban NCore sites. Since ambient lead monitoring has been conducted in the State for more than 3 years and the lead levels have been consistently considerably lower than the NAAQS since the inception of monitoring, RI DEM had asked for and received permission to discontinue monitoring as of June 30, 2016.

Summary of Proposed Changes in the Rhode Island Monitoring Network

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

- When the Urban League building becomes unavailable, or sooner, RI DEM will move one of the PM_{2.5} FRM to Vernon Street and the PM_{2.5} FEM monitor and NATTS monitoring activities at that site to the proposed Community College of Rhode Island location.
- If indicated by resource or logistical limitations, RI DEM may request the reduction of frequency or discontinuation of FRM PM_{2.5} sampling at the Urban League site or its replacement location. FEM PM_{2.5} monitoring will be maintained at that location and the co-located FRM sampler currently operated at Urban League will be moved to the Vernon Street FRM site.
- When necessitated by the progression of highway construction activity to the north side of I-95, RI DEM will discontinue monitoring at the Near-Road site and will ask EPA's approval of future Near-Road monitoring plans for Rhode Island. Work on the north side of the highway is currently scheduled to begin in spring of 2017 or later.

- At this time, we are requesting to modify the State's PM₁₀ network and discontinue operation of the Johnson & Wales site as soon as possible but no later than December 31, 2016. We may consider discontinuation of the Alton Jones site in the future if warranted due to budgetary constraints and will seek EPA approval. RI DEM plans to continue to operate the Alton Jones site for the present time.
- Effective October 1, 2016, the PM_{2.5} FRM at Francis School in East Providence will operate on a 1-in-3 schedule. The continuous PM_{2.5} FRM will become the "primary" monitor at this location, and the FRM will serve as the collocated monitor for the FEM method.
- RIDEM will continue to operate the PM_{2.5} FRM along with the PM_{2.5} FEM at the Alton Jones West Greenwich site for information purposes, but will no longer designate it as a collocated monitor. The FEM will be the primary monitor.
- Effective October 1, 2016, the PM_{2.5} FRM at Urban League will operate on a 1-in-3 schedule. The FRM will remain the primary monitor at this location.
- Effective January 1, 2017, RIDEM will move the second (currently collocated) PM_{2.5} FRM from Urban League to Vernon Street. That FRM will operate on a 1-in-6 schedule and serve as the collocated monitor for the FRM method for Rhode Island at Vernon Street.
- At some future point, if indicated by resource or logistical limitations, RI may request discontinuation of FRM PM_{2.5} sampling at the Urban League site or its replacement location. The FEM PM_{2.5} monitoring will be maintained and would serve as the only PM_{2.5} monitor at this, or the new location.
- EPA's modified lead monitoring requirements at NCore sites were promulgated as proposed, therefore RI DEM has discontinued NAAQS lead monitoring at the E. Providence site as of June 30, 2016.
- RI DEM has purchased a continuous GC and will employ that instrument at the E. Providence site for measuring one-hour speciated VOCs and plans to begin monitoring June 2017.
- RI DEM will implement the revised PAMS requirements as promulgated in the final ozone NAAQS, including the possible expansion of carbonyl monitoring.

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.

Figure 1
Air Quality Monitoring Network
Continous Gas 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



