THE NEW HAMPSHIRE
AMBIENT AIR MONITORING PROGRAM
2017/2018 ANNUAL
NETWORK REVIEW and PLAN

New Hampshire Department of Environmental Services

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THE NEW HAMPSHIRE AMBIENT AIR MONITORING PROGRAM 2017/2018 ANNUAL NETWORK REVIEW and PLAN

prepared by the
Air Monitoring Program

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Introduction

The New Hampshire Department of Environmental Services (NHDES) is pleased to submit this 2017/2018 Ambient Air Monitoring Program Annual Network Review and Plan in accordance with the *Code of Federal Regulations Title 40, PART 58.* Part 1 of this Plan reviews structure, objectives, history and data trends associated with NHDES' Air Monitoring Program (AMP). Part 2 of this Plan details individual air monitoring station information. Part 3 of this Plan details our Photochemical Assessment Monitoring Station (PAMS) Implementation Plan for monitoring organizations required to implement PAMS at NCore sites under the recently revised Environmental Protection Agency (USEPA) monitoring rule (80 FR 65292; October 26, 2015)

PART 1 – 2017/2018 Annual Network Review and Plan

NHDES continually revisits and stresses basic air monitoring fundamentals and efficiency initiatives to allow for reliable, high quality data capture and analysis within a tight budget. Key objectives remain to provide quality ambient air data in order to:

- Determine attainment status with the National Ambient Air Quality Standards (NAAQS, see Table 1.1)
- Guide future air quality policy decisions at the state and national level
- Protect public health through forecasting and real-time mapping and air pollution alert initiatives

Tables 1.8 through 1.11, presented later in this section, summarize the current status of the New Hampshire ambient air monitoring network – July 2016 through June 2017.

Monitoring Objectives

In accordance with the NHDES mission "to help sustain a high quality of life for all citizens by protecting and restoring the environment and public health in New Hampshire",NHDES operates a network of air monitoring sites throughout the state. These sites facilitate monitoring of ambient ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), volatile and semi-volatile organic compounds (VOCs), carbon monoxide (CO), lead (Pb) and particulate matter chemistry (PM, $PM_{2.5}$, PM_{10}). Air monitoring data from NHDES' network helps assess air quality within New Hampshire, evaluate the status of air quality coming from areas upwind and also helps assess our contribution to downwind areas. These data allow NHDES to predict air pollution episodes, enact protective actions and warnings, develop and assess effectiveness of emission reduction strategies and support health assessments and NAAQS reviews.

Ambient air pollution monitoring began in New Hampshire in the 1970s at a few locations. Over subsequent years, it grew to the point where each of the state's 10 counties hosted monitoring stations for air pollutants known to exist in the area. Over time, local industrial facilities either established pollution controls or shut down, resulting in improvements in air quality in those counties. For example, paper mills in Coos County emitted fairly high levels of sulfur dioxide and particles, resulting in periodic unhealthy air quality. Most of these facilities have since shut down and the air quality has improved to the point that there is no longer the need for monitoring in the area. Accordingly, NHDES has reallocated monitoring resources. However, NHDES continues to track emission inventories and reports of health concerns in these areas in order to assess any potential need to reestablish air monitoring infrastructure. In recent years, NHDES has coordinated with USEPA to streamline the monitoring network in order to meet demands for ever increasing efficiency with limited resources. NHDES has given careful consideration to how the need for efficiency would affect network consolidation while maintaining adequate public protection and the ability to track progress.

The current New Hampshire ambient air monitoring network is carefully configured based on air pollution emission patterns to provide air quality data in populated areas which are potentially at risk for unhealthy air quality of one or more pollutants. Most populated areas are represented by an air monitoring station unless previous monitoring has demonstrated that either the community is not at risk or can be adequately represented by a nearby monitor. NHDES also considered topography, geographic coverage, and air pollution modeling in the current network design.

Now, in 2017, most of the major pollution sources that are in operation in New Hampshire are generally well controlled. Areas of continued concern are mobile and area sources where population density and highway networks are dense enough to multiply the emissions of relatively small individual sources hundreds of thousands of times over. The cumulative emissions are greatest in the southeastern portion of the state where population and highway densities are greatest. This region is generally bounded by the Massachusetts state line to the south, Nashua and Manchester to the west, Concord to the north, and Rochester and Portsmouth to the east. This same region is also the most exposed portion of the state to air pollution transport which generally crosses the southeastern part of the state from southwest to the northeast and along the New Hampshire coastline.

Pollutants of most concern in this area in 2017 include ozone, ozone precursors (nitrogen oxides (NOx) and VOCs), $PM_{2.5}$ and SO_2. The New Hampshire monitoring network is most dense in the southeastern portion of the state to reflect potential air quality concerns in heavily populated region with diverse geography. While the greatest risk of unhealthy air quality occurs in this portion of New Hampshire, unhealthy air quality events can occur anywhere in the state for ozone and small particles. Accordingly, the monitoring network for these pollutants extends into all portions of the state. Small particles also lead to visibility impairment, and there are federal regulations to track visibility progress with a special kind of speciation monitoring (IMPROVE) near the Class I airsheds (Great Gulf Wilderness and Presidential Dry-River Wilderness) located adjacent to Mt. Washington in northern New Hampshire.

As part of the 2010 1-hour SO_2 NAAQS implementation, USEPA provided states with the option of performing additional source specific monitoring in support of attainment designation under the Data Requirements Rule (DRR). Beyond special study SO_2 monitoring completed in recent years in the Seacoast region, NHDES does not currently plan to conduct additional source specific SO_2 monitoring in the Seacoast region, or in any other part of the state as part of the DRR.

Network Summary

Below is a brief summary of the New Hampshire Air Monitoring network and the role each station plays for public protection. The list is presented alphabetically by community.

Concord

The Concord monitoring site is primarily intended to track ozone and sulfur dioxide, the only criteria pollutants for which recent air monitoring and modeling have indicated possible population exposure to unhealthy levels. A previous Concord monitoring station was located in the valley near I-93, but was moved to reduce the risks of NOx scavenging caused by nearby freeway traffic emissions and effectively lowering the measured ozone levels in the immediate area. The Hazen Drive site has the advantage of being in close proximity to the NHDES main office, for both outreach opportunities and ease of maintenance. It is also in the proximity of residential neighborhoods, retirement communities and schools. NHDES initiated SO_2 monitoring at this station during October 2010 to help quantify local SO_2 levels relative to the new SO_2 NAAQS. This monitoring was then discontinued at the end of 2016 due to low concentrations measured. The Concord Hazen Drive station represents population on a neighborhood scale.

Greens Grant – Mt. Washington base

The Greens Grant, Camp Dodge ozone monitor at the base of Mt. Washington is now the primary monitor representing the northern portion of New Hampshire. NHDES contracts with the Appalachian Mountain Club for general support and operation of the ozone monitoring at this station. This monitoring location is also important since it represents two federally recognized Class I airsheds which also require IMPROVE visibility monitoring. Personnel from the US Forest Service's White Mountain National Forest operate the IMPROVE sampler. NHDES tracks $PM_{2.5}$ levels measured by the IMPROVE monitor for the purpose of estimating current exposures and the demand for more comprehensive $PM_{2.5}$ monitoring. NHDES consolidated previous monitoring in the North Country (Pittsburg and Conway) at Camp Dodge due to the high correlation between sites, low population densities, and low risk of exposure to unhealthy air quality. This research oriented station also represents population exposure on a regional scale. Mt. Washington summit is not representative of general public exposure in communities located in New Hampshire's northern counties and any attempt to apply this data in that way can result in misleading conclusions.

Keene

The monitoring station in the city of Keene tracks ozone and $PM_{2.5}$ on a continuous basis. The southwest portion of the state experiences a few days per year when ozone levels have the potential to reach unhealthy levels. Similarly, NHDES is concerned about $PM_{2.5}$ levels at this station, especially during the winter months. NHDES installed a continuous $PM_{2.5}$ monitor at this station in September 2007 to better track the risks of wintertime wood smoke buildup. Keene is a prime example of a city distinguished by the factors, such as population density, woodstove use, and valley topography, that are necessary for these winter events. Other nearby communities may be similarly affected. The continuous $PM_{2.5}$ equipment has been invaluable in better understanding the winter $PM_{2.5}$ events and improving air pollution forecasts for the area. The data measured for ozone and non-winter $PM_{2.5}$ are considered valuable on a regional basis, and the data for winter $PM_{2.5}$ is considered non-regional. This station represents population exposure on a neighborhood scale.

Laconia

The Laconia monitor tracks ozone and $PM_{2.5}$ in the “Lakes Region” of the state. The population of this area swells during the summer months with tourists. The monitor represents the very northern edge of the Boston CMSA (combined metropolitan statistical area) and periodically experiences elevated ozone levels. This station represents population exposure on a regional scale. As part of a special study, a temporary monitoring station was operated at Wyatt Park from October 2016 through April 2017 to assess wood smoke concentrations in the community.

Lebanon

The Lebanon monitoring station is sited to provide population and regional based monitoring for the Lebanon/White River Junction (VT) metropolitan area with information on regional ozone and $PM_{2.5}$. This site is also important since it represents the consolidation of the closed Claremont (ozone) and Haverhill (ozone and $PM_{2.5}$) monitoring stations. The station is located on a ridge at the Lebanon airport, just above the river valley. The site was chosen primarily to represent the regional exposure, and the station is important to the New Hampshire network for its geographic coverage. This station represents population exposure on a regional scale.

Londonderry

The Londonderry station came online January 1, 2011 as an NCore superstation measuring a wide selection of pollutants. NHDES worked closely with USEPA to carefully select this site for its central proximity to the highly populated southeastern suburban portion of New Hampshire. The site has no nearby emission sources of significance, but lies in the air pollution transport corridor that crosses the southern portion of the state. The site is expected to track a number of potentially unhealthy ozone events each year. NHDES relocated photochemical assessment monitoring (PAMS) from Nashua to this station in April 2015. PAMS measures important precursors to the development of ozone. These precursors include a wide variety of volatile organic compounds and nitrogen oxides. Being a multi-parameter station located in an area representative of a large population living in the northern suburbs of Boston, as well as between the major population centers of Nashua and Manchester, the data collected at this site will be ideal for future research and health-related analysis. This station also pairs with the Pack Monadnock NCore station to give the low elevation perspective as compared to Pack Monadnock’s high elevation data for similar air masses transported into the area. This station represents population exposure on a regional scale.

Mt. Washington – Summit

The Mt. Washington summit monitoring site is of special value for scientific research for tracking ozone transport. The summit is located at 6,288 feet above sea level and is far away from any significant pollution sources; thus it is ideal for picking up long-range pollution transport into the northern portion of the state. The data are often compared to the data collected at Greens Grant (Camp Dodge) located at the base of the mountain, just a few miles to the east, to give a vertical gradient perspective. Ozone levels measured at the summit are normally higher than measured at the base and occasionally reach unhealthy levels. This station provides valuable high elevation data on a regional scale, but should not be considered representative of population exposure in nearby communities at lower elevation.

Nashua – Gilson Road

In past years, the Nashua area often saw the highest ozone concentrations in the state and thus there is an ongoing need to continue tracking ozone in this area. While this station is on the upwind side of the city of Nashua, it is critical to the network for tracking transport into the state and into the city of Nashua from the southwest. This station represents population exposure on a regional scale.

Peterborough, Pack Monadnock Mountain – Summit (Miller State Park)

NHDES has monitored several parameters at the Pack Monadnock station since 2002 and it became the state's second NCore site in 2011. The site's true value lies in the fact that it is located on a rural mountain top in the south-central portion of the state. At 2,288 feet above sea level, the station is ideally located to pick up the transport airflow from the heavily populated northeast urban corridor (Washington, D.C. to Boston, MA) and is at the northern terminus of the low-level jet that begins near the middle of Virginia. This non-population-based monitor does not have nearby sources of significance. This site measures a wide variety of pollutants, including PAMS ozone precursors, IMPROVE, ozone, and $PM_{2.5}$. Due to its location and elevation, NHDES considers this station to be of high scientific value for transport measurements on a regional scale. When paired with data collected at Londonderry, Peterborough PAMS and $PM_{2.5}$ data provide a critical high-low cross section for regional photochemical models.

Pembroke

The Pembroke monitoring station is located along the Merrimack River, just to the south of Merrimack Station power plant. The power plant is a large coal burning source which until recently caused relatively high levels of SO_2 at this monitor. While the power plant recently completed pollution control upgrades for SO_2, this station tracks progress in reducing emissions and measures exposure to SO_2 in a nearby community. This station represents population exposure to SO_2 and $PM_{2.5}$ on a local scale.

Portsmouth

The Portsmouth monitoring station is located on Peirce Island on the Piscataqua River just to the east of downtown Portsmouth. NHDES has been successful in establishing a long-term agreement for siting at its current location and has found the location to be suitable for tracking emissions from around the Portsmouth and Kittery (ME) areas. The station also picks up some sea breeze ozone events that work their way up the river. This station represents population exposure on a limited regional scale.

Rye

The Rye Monitoring station is located at Odiorne State Park. Its purpose is primarily to track summertime ozone events brought ashore by sea breezes. Past experience monitoring ozone in Rye found that these events sometimes result in measurements of ozone among the highest in the state. These events affect the coastline area and rarely penetrate more than a few miles inland. The data from this site are of scientific interest for air pollution flow dynamics when compared with data from Portsmouth station. This station represents a specific and limited population along the New Hampshire coastline for these periodic high ozone events.

$PM_{2.5}$ Beta Attenuation Federal Equivalency Method (FEM) Monitoring

NHDES operates several Met One 1020 BAMs and one API 602 BAM covering a total of five stations. To date, NHDES operates BAMs and Federal Reference Method (FRM) filter based samplers at Keene, Lebanon, Londonderry, Peterborough and Portsmouth stations. Please note below information relative to data comparability assessments (FEM vs FRM) and declaration of primary sampler type for each station. For more information, see data Comparability Assessments in Appendix A and at the following link: https://www.epa.gov/outdoor-air-quality-data/pm25-continuous-monitor-comparability-assessments.

Keene - The Met One 1020 BAM data at Keene will remain primary data toward the NAAQS. Any FRM data generated at Keene will be considered secondary when BAM data are available. In contrast to this decision, individual seasonal data comparisons are outside acceptability limits and all FRM and FEM data for the past three years (2014 – 1016) appear to fall outside additive vs. multiplicative bias acceptability limits for FEM testing. These data sets correlate with an overall R^2 = 0.64 and an intercept of +2.3 micrograms per cubic meter ($\mu g/m^3$). These statistics show a progressive trend from last year. And, these data are significantly skewed based on one FRM outlier collected on 1/12/15. NHDES flagged this data point as an outlier, but it is still being used to generate these statistics on USEPA's data assessment tool. Due to this one outlier data point, the BAM to FRM correlation for all data in 2015 look -awry with an R^2 of 0.55 (Figure 1.1). However without that outlier (Figure 1.2) the 2015 data correlation looks much better with an R^2 = 0.83. Due to these positive trends with the FRM to FEM correlations, NHDES believes that the BAM data should remain primary towards the NAAQS at Keene.

Lebanon - The Met One 1020 BAM data at Lebanon will remain primary toward the NAAQS. Any FRM data generated at Lebanon will be considered secondary when BAM data are available. The 2016 yearly data set is outside additive vs. multiplicative bias acceptability limits. However, the 2014 data set is very close to these acceptability limits – and – the 2015 data set is within these acceptability limits. When looking at the complete data set, the FRM and FEM data for the past three years falls very close to the additive vs. multiplicative bias acceptability limits for FEM testing. These three years of data correlate with an overall R2 = 0.79 and an intercept of -0.26. These statistics show a progressive trend from last year when the R2 and intercept were 0.77 and -0.3, respectively.

Figure 1.1 :

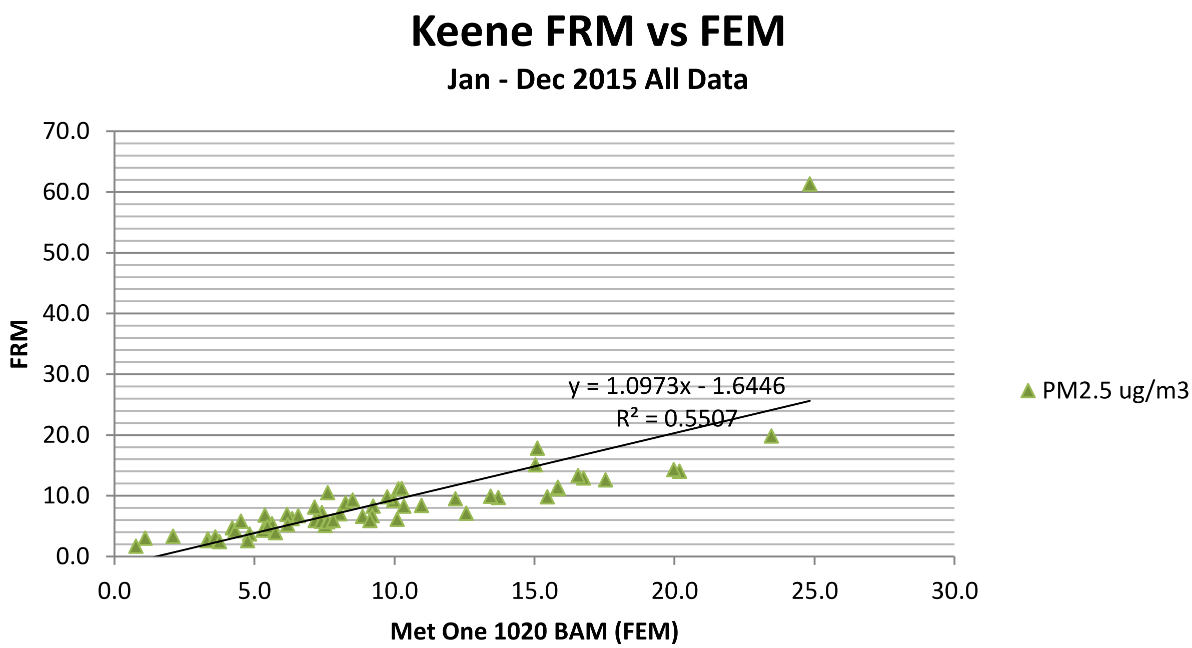
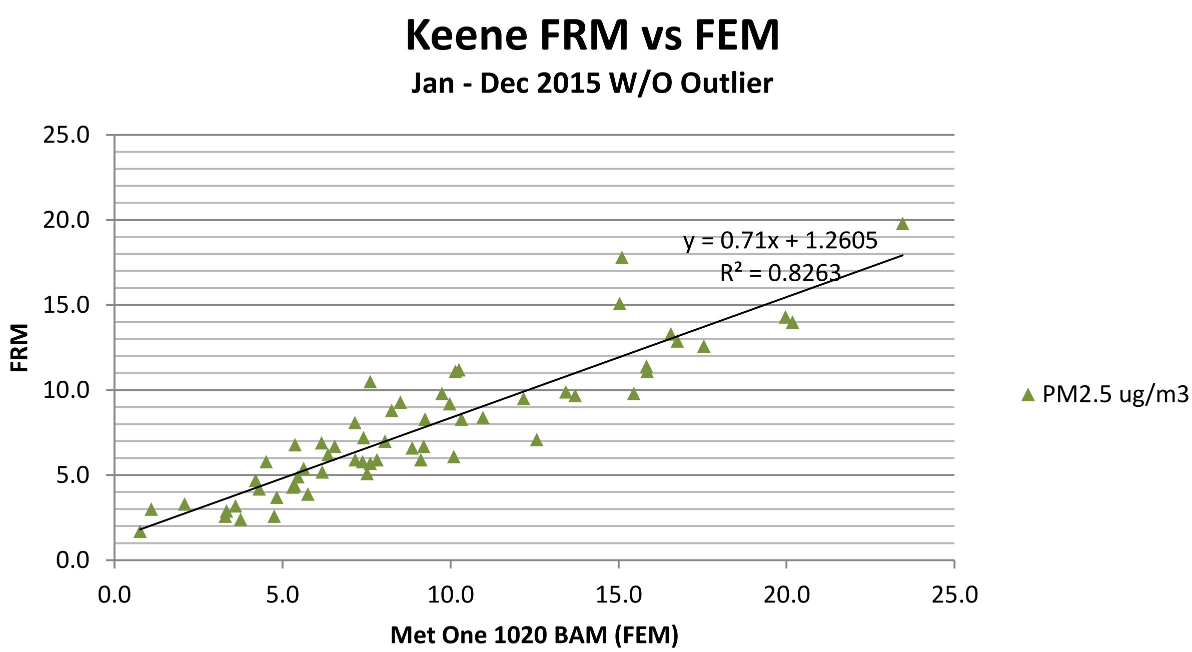
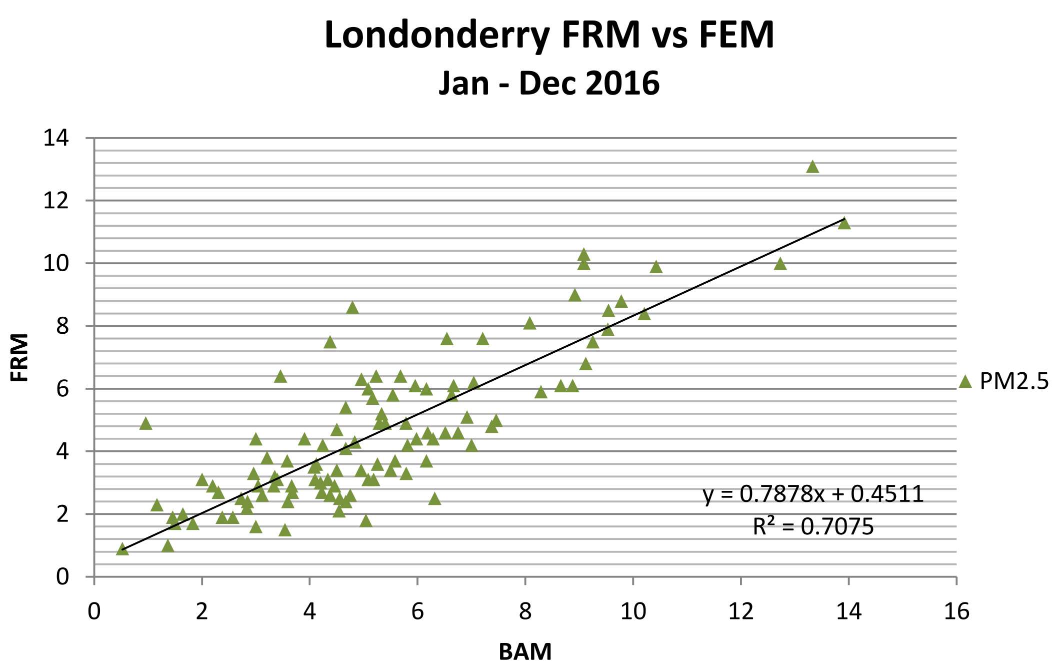


Figure 1.2 :



Londonderry – The Met One 1020 BAM data at Londonderry will remain primary toward the NAAQS. NHDES had requested that the PQ200 (FRM) be the primary sampler for 2015 due to poor correlations between the FRM and FEM at this station for the 3 prior years (2012 – 2014). However, after a review of the 2015 and early 2016 FEM to FRM correlations and trends at this site, NHDES requested that the BAM be used as primary toward the NAAQS, again. EPA concurred. Viewing acceptable additive and multiplicative bias information generated by the Comparability Assessments (Appendix A) can be confusing due to the varied $PM_{2.5}$ reporting from this station. However, NHDES believes that optimistic correlation trends are clearer when viewing correlation information from annual data. Noticeably, 2014 and 2015 data sets did not compare very well. All FRM and FEM data from 2014 correlated with an R^2 of 0.58 and an intercept of -1.3. All FRM and FEM data from 2015 correlated with an R^2 of 0.46 and an intercept of +1.2. In contrast to these data sets, all FRM and FEM data from 2016 correlated with a much better R^2 of 0.71 and an intercept of +0.7 (See Figure 1.3).

Figure 1.3



Peterborough, Pack Monadnock Mountain – Summit (Miller State Park) - The Met One 1020 BAM at Peterborough will remain primary toward the NAAQS. Any FRM data generated at Peterborough will be considered secondary when BAM data are available. All 2014, 2015 and 2016 valid FRM and FEM data from Peterborough are within additive vs. multiplicative bias acceptability limits for FEM testing. The three-year data set correlates with an overall R^2 = 0.62 and an intercept of +1.94. The 2016 data, however, is outside these acceptability limits (see Comparability Assessments in Appendix A). The 2016 comparability

Assessment data should be viewed with some uncertainty based on a number of factors. Outliers, low data and method differences are key factors in this uncertainty. The 2016 data set is marked with one key day of FRM vs FEM data that did not compare well on 5/27. NHDES flagged this data as an outlier, but it is still being used to generate statistics in EPA's data assessment tool.

Portsmouth - API 602 BAM data at Portsmouth will be primary toward the NAAQS. Any FRM data generated at this station will be considered secondary when BAM data are available. The API 602 BAM has correlated quite well with the FRM when operational. All valid FRM and API602 FEM data sets from Portsmouth for the past three years are within or very close to additive vs. multiplicative bias acceptability limits for FEM testing. This three-year data set correlates with an overall R^2 = 0.88 and an intercept of -0.2.

There are a number of factors that work against good correlation between FRM and FEM data. Some of these factors can be controlled by a monitoring organization and some cannot. NHDES continually strives to get better correlations through process control and limiting variables that we can control. However, there are basic uncontrollable differences between the FRM and FEM methods that work against good correlations. One key uncontrollable factor relates to volatiles and semi-volatile components in the air mass. Key differences between these two methodologies are based on the time between sample collection and sample analysis. The FEM BAM collects and analyzes each sample over discrete one hour time periods, whereas the FRM collects the sample over an integrated 24 hour period, with analysis performed several weeks later. This extended time period between sampling and analysis for the FRM likely allows volatile and/or semi-volatile compounds (when present) to leave the sample media prior to analysis – creating a negative bias when compared to the BAM.

Network Modifications

NHDES made the following modifications to the air monitoring network between July 1, 2016 and June 30, 2017.

Concord SO_2 – NHDES discontinued SO_2 monitoring in Concord on December 31, 2016 due to low concentrations measured.

Laconia $PM_{2.5}$ – As part of a special study, NHDES established a temporary winter $PM_{2.5}$ monitoring platform near downtown Laconia during the 2016-2017 winter season. A report will be generated based on final quality assured $PM_{2.5}$ BAM and Aetholometer data generated during this study.

Londonderry PM_{10} and Lead – In accordance with recent modifications to 40 CFR Part 58 and the low concentrations measured, NHDES discontinued lead monitoring at the Londonderry station on June 30, 2016. In conjunction with discontinuing lead monitoring, NHDES discontinued filter based PM_{10} monitoring and installed and operated a continuous (hourly) PM_{10} Met One BAM. The $PM_{10-2.5}$ data collected from this site (and Peterborough) now warrant special consideration. NHDES collect these data with two Met One Beta Attenuation Monitors (BAM)s in accordance with method EQPM-0709-185; the only exception being the NHDES does not use the BX-Course kit specified in the method. As an alternative, NHDES operates both BAMs in local conditions and simply subtracts the corresponding hourly digital data to get the PM10-2.5 data. These data are identical to the data that would be generated using the BX-Course kit.

Plymouth $PM_{2.5}$ – As part of a special study, NHDES established a temporary winter $PM_{2.5}$ monitoring platform near downtown Plymouth during the 2016-2017 winter season. A report will be generated based on final quality assured $PM_{2.5}$ BAM and Aetholometer data generated during this study.

Portsmouth PM_{10} – NHDES discontinued the filter based PM_{10} sampling at this station on December 31, 2016. NHDES will continue to collect PM_{10} data with the API602 continuous BAM and operate a filter based PM_{10} on a 1 in12 day schedule as a colocation check for the BAM.

Future Plans

In support of continuous efforts to improve performance and maximize network efficiency under a constrained budget, NHDES continues to seek efficiencies where possible within the network. NHDES presents the following future plans.

PAMS – Part 3 of this document details our PAMS Implementation Plan for monitoring organizations required to implement PAMS at NCore sites. Additionally, the two New Hampshire PAMS sites will discontinue its 24 hour can sampling protocol. Effective for the 2017 monitoring season, the sites will no longer collect and analyze a 24 hour can on the one and six day sampling schedule. One can will still be collected monthly and run in duplicate at each site for precision data only.

Laconia, Green Street – Preliminary assessment of the special $PM_{2.5}$ monitoring study data at Wyatt Park showed higher than expected $PM_{2.5}$ concentrations. As a result, NHDES proposes to relocate all parameters monitored at Laconia, Green Street to a yet to be determined in-town location. Ozone monitoring will continue to be performed at this new location and NHDES proposes to install a $PM_{2.5}$ BAM unit to track diurnal patterns and local population risk to wood smoke.

Wood Smoke Monitoring – During summer 2017, NHDES will perform a community review and perform a modeling study with EPA's Valley Identification Tool and should another New Hampshire community be identified for a special monitoring study, NHDES will work with EPA to establish a temporary monitoring site for winter 2017-2018.

Purchasing/Expenses

NHDES' budget cycle runs from July 1 through June 30 each year. The Air Monitoring Program received some limited funding through the New Hampshire Capital Budget for equipment procurement during the previous budget cycle. With those funds NHDES chose to update our antiquated air monitoring equipment by procuring four ozone analyzers, two NOy analyzers, one beta attenuation monitor, three flow standards, two filter based particle samplers, three data loggers, two dilution calibrators and two zero air generators. Additionally, with the balance of those one-time funds, NHDES procured PAMS parts, two temperature controlled compact structures, a web camera, an ozone calibrator and nine sets of meteorological (wind direction and speed) sensors during this budget cycle.

NHDES utilized almost all federal funding for air monitoring for personnel, consumables, parts and supplies to operate the air monitoring network. Additionally, NHDES maintains fleet vehicles, updates maintenance and station contracts, pays utilities for existing facilities, and enhances air monitoring stations as needed throughout the network. Other key expenses include calibrating, repairing, and maintaining equipment to meet USEPA and safety standards.

Please note that a number of analyzers and samplers in NHDES' network are old and require frequent maintenance in order to assure adequate data capture. Of note, a majority of NHDES' filter-based particle samplers are near the end of their lifetime. Table 1.0 presents equipment, analyzer, and sampler types that NHDES currently uses for ambient air quality monitoring.

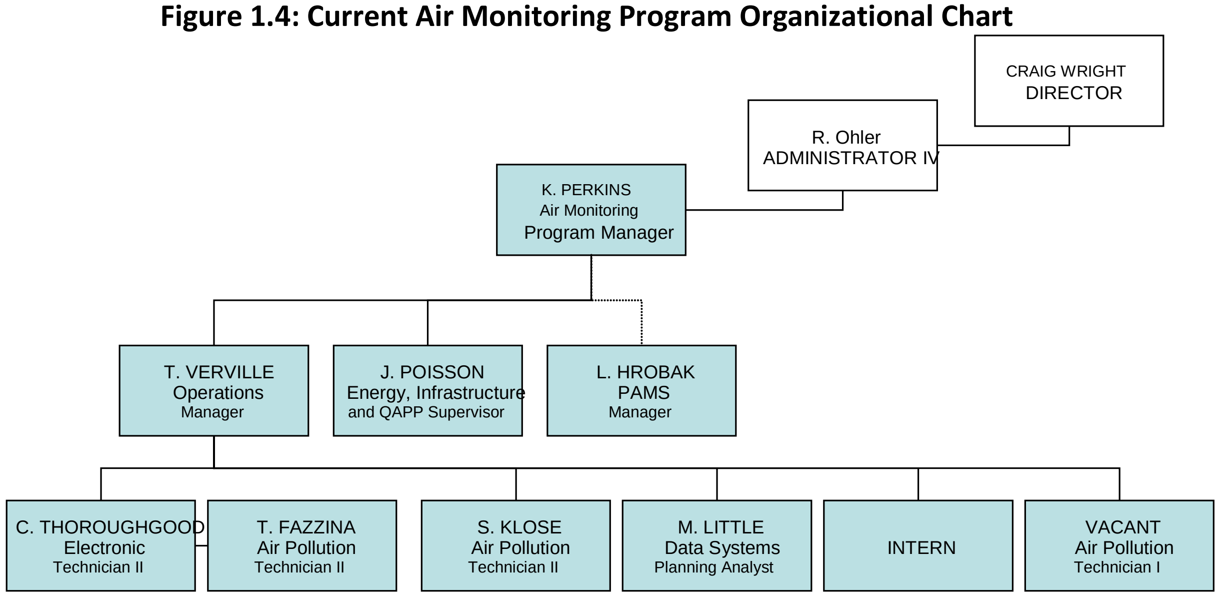
Table 1.0 : Equipment – (Method)
SO_2
Teledyne – API 100A and EU – (Automated Equivalent Method EQSA-0495-100)
Teco 43A – (Automated Equivalent Method EQSA-0486-060)
Teco 43C – (Automated Equivalent Method EQSA-0486-060)
Thermo 43i – (Automated Equivalent Method EQSA-0486-060)
CO
Teco 48C - (Automated Reference Method RFCA-0981-054)
Thermo 48i – (Automated Reference Method RFCA-0981-054)
Teledyne – API 300 EU – (Automated Equivalent Method RFCA-1093-093)
O_3
Teledyne – API 400E - (Automated Equivalent Method EQOA-0992-087)
Teco 49 - (Automated Equivalent Method EQOA-0880-047)
Teco 49C - (Automated Equivalent Method EQOA-0880-047)
Thermo 49i - (Automated Equivalent Method EQOA-0880-047)
Teco 49C PS – (Lab Standard EQOA-0880-047)
NO_2
Teledyne – API 200E – (Automated Reference Method RFNA-0691-082)
Teco 42C – (Automated Reference Method: RFNA-1289-074)
Thermo 42i – (Automated Reference Method RFNA-1289-074)
NOy
Ecotech Model 9843 NOy
Particulate Matter
R&P Partisol Model 2025 (filter based)
BGI Model PQ200 (filter based)
Met One BAM Model 1020

Table 1.0 : Equipment – (Method)
API 602 BAM
IMPROVE Visibility Speciation Monitor
Calibrator (multiple parameter)
TECO 165 Multi Gas Calibrator
Teledyne – API Model 700, 700E and 700U Gas Calibrators
Environics Series 6103 Multi Gas Calibrator
2B Technology Model 306 Ozone Calibrator
Data Acquisition System
Environmental Systems Corporation (ESC and Agilaire) Data Loggers Models 8816, 8832 and 8872
PAMS
Perkin Elmer Ozone Precursor System- Clarus 500 Gas Chromatograph, TurboMatrix 100 Thermal Desorber / TM50
Perkin Elmer Total Chrome Software- version 6.2.1
Parker Balston TOC Gas Generator
Parker Balston Hydrogen Generator

Personnel

The AMP continues to operate with one full-time technical position vacant as well as one technical position previously eliminated. Due to limited budget, NHDES is unable to fill the vacant position during the next year. In order to fulfil requirements, NHDES assigns some technical support duties to individuals outside the official AMP organizational structure, including PAMS management duties. See Figure 1.6.

Figure 1.4: Current Air Monitoring Program Organizational Chart



Cooperative Air Monitoring Initiatives

NHDES is involved in numerous cooperative air monitoring initiatives with local, state and private entities.

For over 26 years now, the Appalachian Mountain Club (AMC) and NHDES have been joining resources to conduct ozone monitoring in Coos County. Since 1990, AMC and NHDES have been cooperatively monitoring ozone on the summit of Mount Washington to determine the exposure of hikers and other visitors to this pollutant and to quantify ozone transport from upwind areas. Significant levels of ozone have been measured on the summit during the summer months throughout this time. Also, AMC and NHDES began cooperatively managing a second monitoring station near the base of Mount Washington (Camp Dodge) in 1996, a White Mountain National Forest Class I Wilderness visibility monitoring station. AMC's involvement in air monitoring activities saves NHDES significant resources.

NHDES also partners with the US Department of Agriculture (Forest Service) in a Challenge Cost Share Agreement relative to air monitoring activities at Camp Dodge in Green's Grant. This agreement provides a framework of cooperation for station work such as upgrades, tree trimming and routine costs. The Forest Service operates an IMPROVE (Interagency Monitoring of Protected Visual Environments) sampler at this station. NHDES and AMC currently maintain ozone sampling, upkeep and routine site inspections at this station.

NHDES provides critical real-time rainfall data from the Laconia station for the protection of public health. When rainfall at the Laconia station exceeds a specific amount over a specific time period, an automated notification system operated by NHDES facilitates closing of a public beach and alerts of possible bacterial dangers. Similar notification systems incorporating our real-time meteorology data have been used to enact erosion control inspections at various New Hampshire Department of Transportation road construction projects.

NHDES maintains a near real-time air quality and forecasting website at: http://www2.des.state.nh.us/airdata/default.asp and contributes to a regional air quality website maintained by USEPA (http://www.epa.gov/region01/airquality/fc-ne0.html). These sites provide forecast information on New Hampshire's air quality that can be used by media, medical professionals, schools and athletic coaches, and individuals, to help plan daily activities and protect public health. The air quality forecast for New Hampshire is also available on the NHDES' Air Quality Information Line at (800) 935-SMOG. The forecast is made for ground-level ozone and particle pollution.

Monitoring Trends

Each year, NHDES reviews its monitoring data and calculates design values for comparison to the National Ambient Air Quality Standards (NAAQS) – Table 1.1. USEPA establishes these standards to protect public health and welfare. In general, design values consider the three most recent years for an averaging period in the form of the NAAQS, such as looking at the three-year average of the annual fourth highest ozone 8-hour value.

New Hampshire air quality data trends reveal the important progress that has been made in improving air quality in New Hampshire. Cleaner vehicles, fuels, power plants, industry and small engines located throughout the region have all contributed to much-improved air quality since the 1980s. More recent trends show that additional progress is still being made, but the task becomes more difficult as there are becoming fewer pollution sources that remain uncontrolled. It is also important to note that while progress has been made, the NAAQS have been strengthened in some cases to be more protective, thus we have more progress to make.

Figures 1.7 through 1.20 present monitoring trends for the key criteria pollutants for the period 2000 through 2016. In all cases, air quality is significantly improved from the 1970s and 1980s. Currently monitored levels of nitrogen dioxide (NO_2), PM_{10}, lead (Pb) and carbon monoxide (CO) are safely below the current levels of the NAAQS. However, the NAAQS for ozone, $PM_{2.5}$, and SO_2 have all recently been tightened (lowered) to levels near what is currently being measured in New Hampshire. Two of these pollutants (ozone and $PM_{2.5}$) have drawn significant attention by NHDES as a focus for network monitoring and SIP planning. For SO_2, 1-hour NAAQS was recently added with a threshold of 0.070 parts per million (ppm), and NHDES is assessing its monitoring focus on a source-specific basis in order to address attainment requirements.

Existing SO_2 monitoring indicates that all areas of New Hampshire meet the 3-hour SO_2 secondary NAAQS. Monitoring also indicates that Londonderry, Pack Monadnock, Manchester and Portsmouth are below the new 1-hour primary SO_2 NAAQS. The Pembroke monitoring station historically measured 1-hour SO_2 concentrations above the 0.075 ppm threshold until 2012. This station was sited as a source-specific monitor, located near a coal-burning power plant. In 2011 the power plant began operations of a new SO_2 scrubber which has significantly lowered its SO_2 emissions. As a result, the Pembroke monitor recorded a decrease from 57 daily maximum 1-hour SO_2 exceedances of 0.075 ppm in 2011 to just one exceedance of the same threshold in 2012 and none since 2013. Table 1.2 summarizes exceedances of NAAQS thresholds during recent years.

Tables 1.3 through 1.7 provide the maximum of the five most recent design values and most recent (2014-16) design values for each criteria pollutant. These are also expressed as percentages of the current NAAQS. CO, NO_2, and 1- and 3-hour SO_2 design values are all under 30% of the NAAQS during the 2014-16 design value period. The highest SO_2 site, Pembroke, last exceeded the 1-hour NAAQS for the period of 2011 to 2013, but now meets the standard. With the lower ozone standard of 0.075 ppm, Rye and Pack Monadnock summit just barely exceeded the standard during the period of 2007 to 2009, but since then these and all other sites have been under the standard, including during the 2014-2016 period.

Table 1.1: National Ambient Air Quality Standards

Pollutant [links to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 μg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 μg/m^3	annual mean, averaged over 3 years
		secondary	1 year	15.0 μg/m^3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 μg/m3 as a calendar quarter average) also remain in effect.
(2) The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.
(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.
(4) The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)), A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the require NAAQS.

Table 1.2: NAAQS Exceedances (Days) in New Hampshire (2011-2016)

Parameter/Location/Standard	Number of Exceedances 2011	2012	2013	2014	2015	2016	Most Recent (Relative to NAAQS from Each Year)
CO							
1-Hour (1971 standard)	0	0	0	0	0	0	1978
8-Hour (1971 standard)	0	0	0	0	0	0	1996
Lead							
Quarterly (2008 standard)	0	0	0	0	0	--	None
NO_2							
1-Hour (2010 standard)	0	0	0	0	0	0	None
Ozone							
8-Hour (2008 standard 2011-14; 2015 standard 2015-16)							
Camp Dodge	0	0	0	0	0	0	2004
Concord	0	0	0	0	1	0	2015
Keene	0	0	0	0	0	1	2016
Laconia	0	0	0	0	0	0	2010
Lebanon	0	0	0	0	0	0	2008
Londonderry	1	2	0	0	1	1	2016
Manchester	--	--	--	--	--	--	2010
Miller	0	2	0	1	2	3	2016
Mt. Washington[1]	0	0	2	0	5	2	2016
Nashua	1	2	0	0	1	1	2016
Portsmouth	1	1	1	0	1	0	2015
Rye	2	1	0	0	1	1	2016
Woodstock	0	0	0	0	0	0	None
PM_{10}							
24-Hour (1987 standard)	0	0	0	0	0	0	1989
$PM_{2.5}$							
Annual (2012 standard)	0	0	0	0	0		None
24-Hour (2006 standard)							
Keene	4*	1*	3*	0*	0*		2013
Laconia	0	0	0	0	0		None
Lebanon	0*	0*	0*	0*	0*		None
Miller	0*	0*	0*	0*	0*		2002(Exceptional Event)
Nashua	0	0	0	0	--		2002 (Exceptional Event)
Pembroke	0	0	0	0	--		None
Portsmouth	0*	0*	0*	0*	0*		None
SO_2							
Annual (1971 standard)	0	0	0	0	0	0	None
1-Hour (2010 standard)							
Concord	5	0	0	0	0	0	2011
Londonderry	0	0	0	0	0	0	None
Manchester	1	--	--	--	--	--	2011
Miller	0	0	0	0	0	0	None
Pembroke	57	1	0	0	0	0	2012
Portsmouth	0	0	0	0	0	0	None

** - Denotes measured by FEM equipment; otherwise measured by FRM method. ^ - Denotes exceptional event.*

Station startups/closures: Manchester closed in 2011; Nashua ($PM_{2.5}$) and Pembroke ($PM_{2.5}$) shut down in 2015; Londonderry opened January 1, 2011; Concord station began SO_2 monitoring in 2011; lead monitoring was discontinued at end of 2nd quarter 2016.

[1] Mt. Washington ozone exceedances exclude the second of overlapping 8-hour periods (ie. those beginning hours 00:00-06:00) per the 2015 standard final rule; the 2015 count also includes an exceedance in October, outside the ozone season.

Table 1.3: 2014 – 2016 Ozone Design Values (ppb)

Ozone	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2014-16 Max DV	% of NAAQS	Location
8-Hour	3-year average of 4th- highest daily maximum 8-hour averages	70 (2015-16); 75 (2008-14)	70	93*	Peterborough (2010-12)	68	97*	Peterborough

* The five-year maximum design value is presented as a percentage of 75ppb, the NAAQS in place during the design value period in which the maximum occurred; the 2014-16 maximum design value is relative to 70ppb, the NAAQS in place during the most recent design value period.

Table 1.4: 2016 Carbon Monoxide Design Values (ppm)

CO	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2016 Max DV	% of NAAQS	Location
1-Hour	2nd maximum	35	2.1	6	Manchester (2012)	0.5	1	Londonderry
8-Hour	2nd maximum	9	1.3	14	Manchester (2012)	0.4	4	Londonderry

Table 1.5: 2014 – 2016 Sulfur Dioxide Design Values (ppb)

SO_2	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2014-16 Max DV	% of NAAQS	Location
1-Hour	3-year average of 99th percentile of daily maximum 1-hour averages	75	157	209	Pembroke (2010-12)	22	29	Portsmouth
3-Hour	2nd maximum	500	28	6	Pembroke (2012)	12	2	Pembroke

Table 1.6: 2014 – 2016 Nitrogen Dioxide Design Values (ppb)

NO_2	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2014-16 Max DV	% of NAAQS	Location
1-Hour	3-year average of 98th percentile of daily maximum 1-hour averages	100	11*	11*	Nashua (2010-12)*	--*	--*	--*
Annual	Annual average	53	3	6	Londonderry (2013-15, 2014-16)	3	6	Londonderry

* Only seasonal data are available for 2009-11 and 2010-12, and more recent design value periods are seasonally and annually incomplete.

Table 1.7: 2014 – 2016 Fine Particulate Matter Design Values (µg/m^3)

$PM_{2.5}$	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2014-16 Max DV	% of NAAQS	Location
24-Hour	3-year average of 98th percentile of midnight- midnight 24-hour averages	35	29	83	Keene (2011-13)	24	69	Keene
Annual	Annual average over 3 years	12	9.1	76	Keene (2010-12, 2011-13)	7.9	66	Keene

Figure 1.5: Ozone trends for the 8-hour NAAQS (2000-2016)

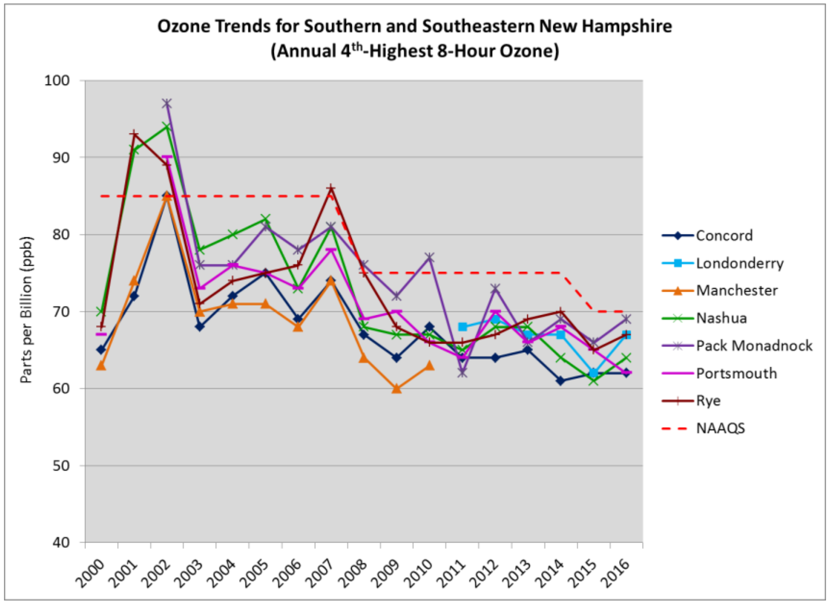


Figure 1.6: Ozone trends for the 8-hour NAAQS (2000-2016)

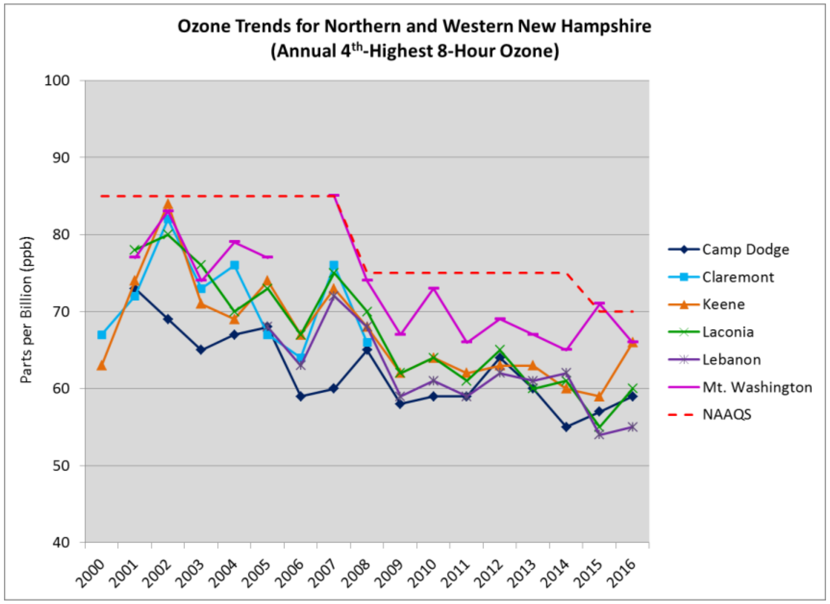


Figure 1.7: Carbon Monoxide trends for the 1-hour NAAQS (2000-2016)

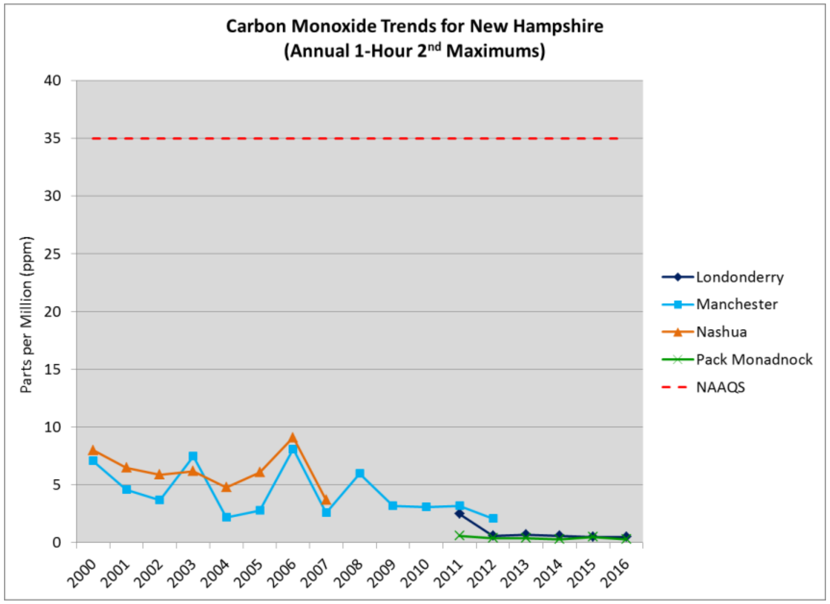


Figure 1.8: Carbon Monoxide trends for the 8-hour NAAQS (2000-2016)

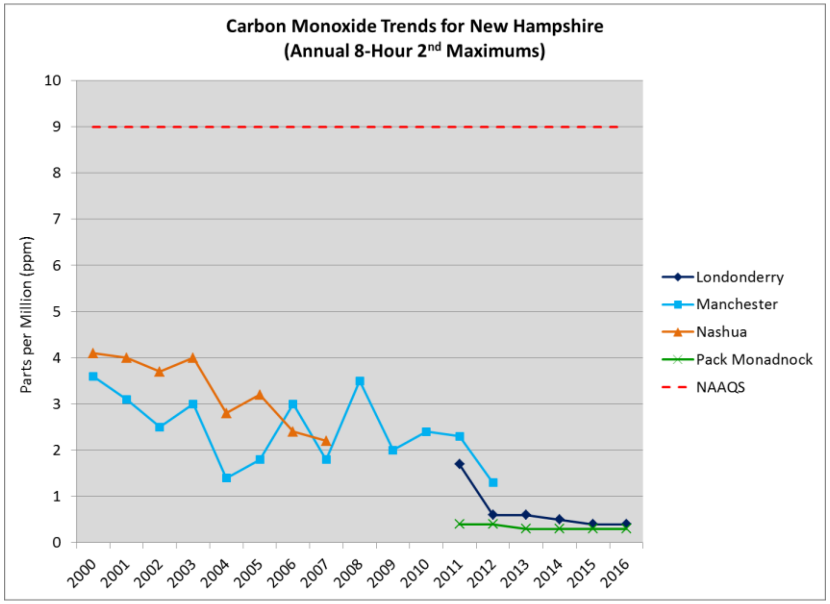


Figure 1.9: $PM_{2.5}$ trends for the 24-hour NAAQS (2000-2016)

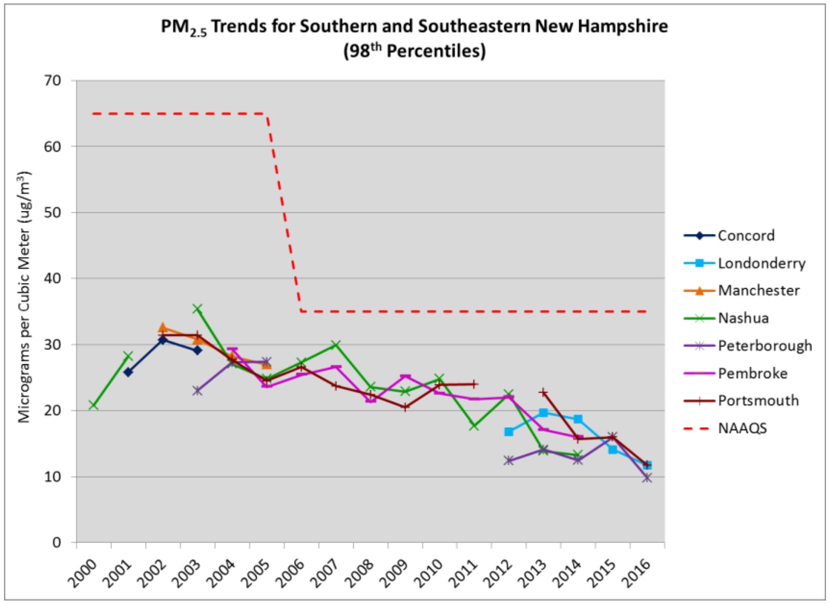


Figure 1.10: $PM_{2.5}$ trends for the 24-hour NAAQS (2000-2016)

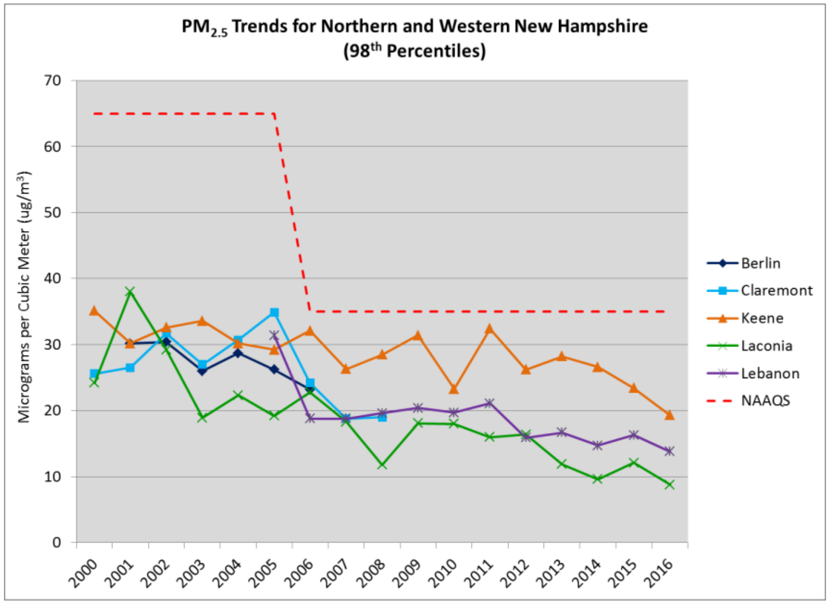


Figure 1.11: $PM_{2.5}$ trends for the annual NAAQS (2000-2016)

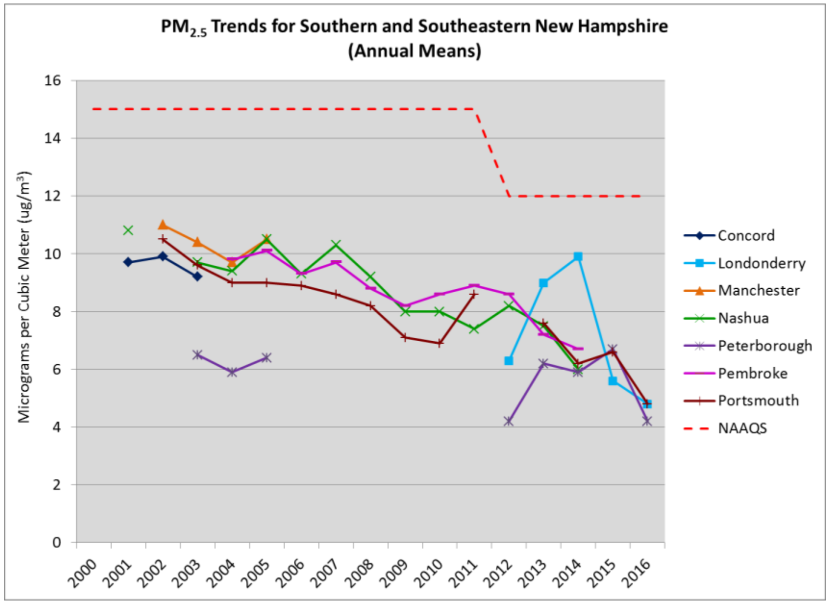


Figure 1.12: $PM_{2.5}$ trends for the annual NAAQS (2000-2016)

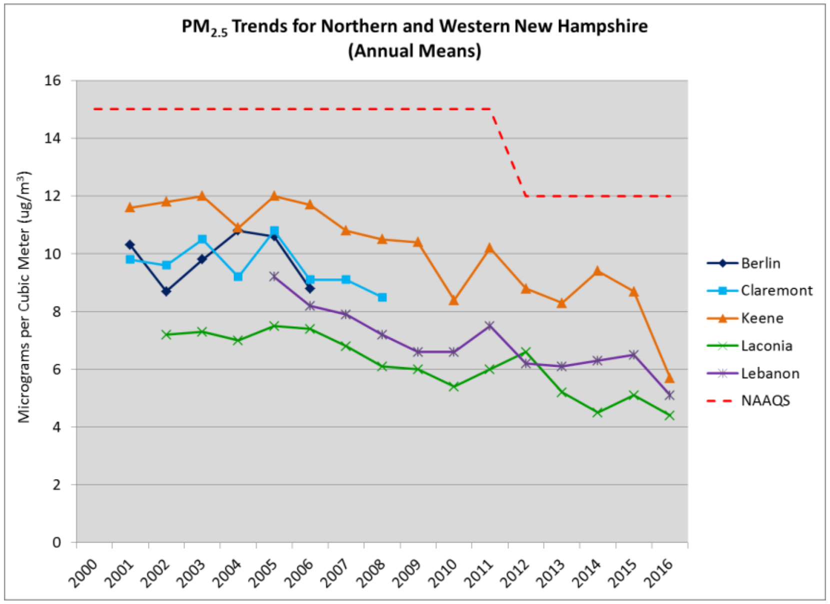


Figure 1.13: Nitrogen Dioxide trends for the 1-hour NAAQS (2000-2016)

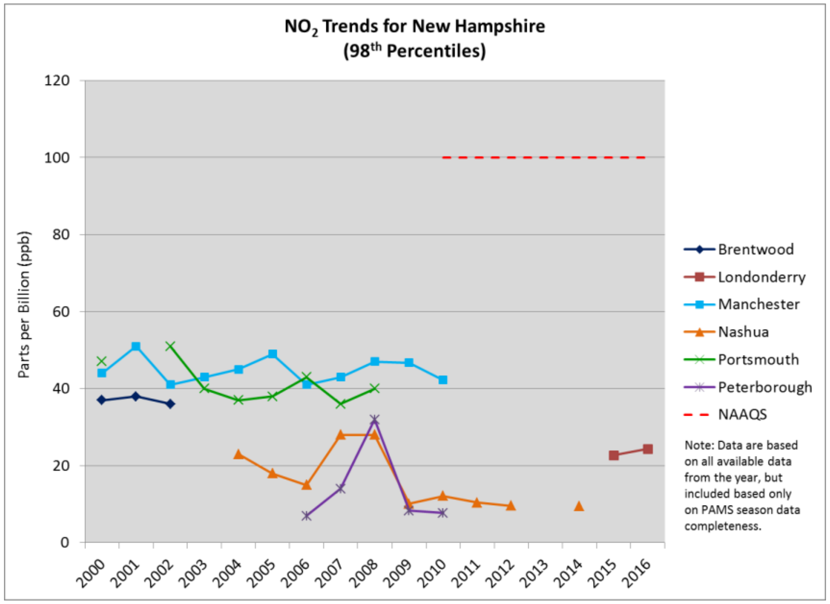


Figure 1.14: Lead trends for the annual NAAQS (2012-2016)

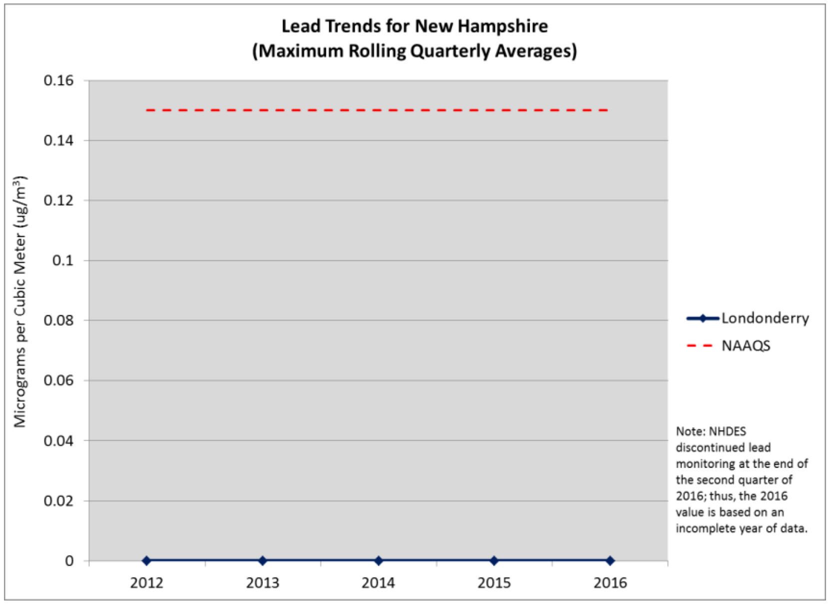


Figure 1.15: Sulfur Dioxide trends for the 1-hour NAAQS (2000-2016)

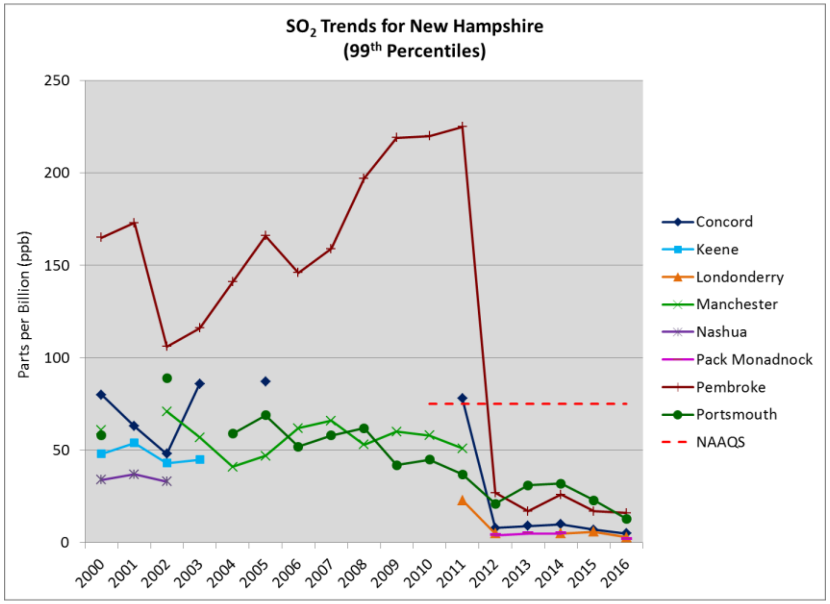


Figure 1.16: Sulfur Dioxide trends for the 3-hour NAAQS (2000-2016)

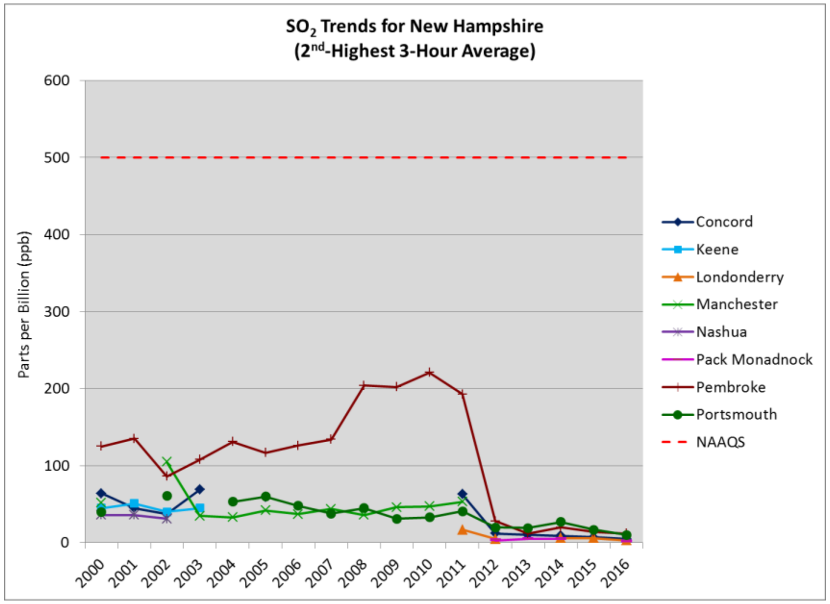


Figure 1.17: PM_{10} trends for the 24-hour NAAQS (2000-2016)

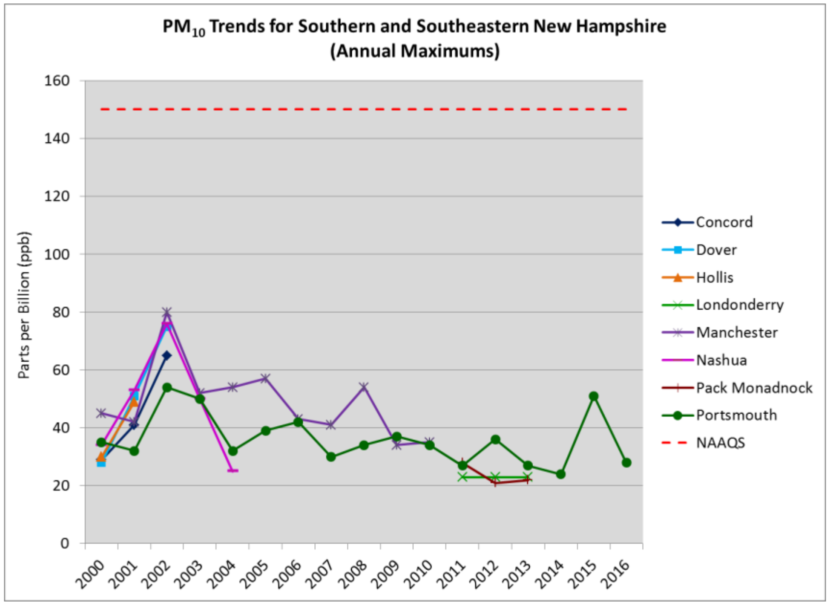
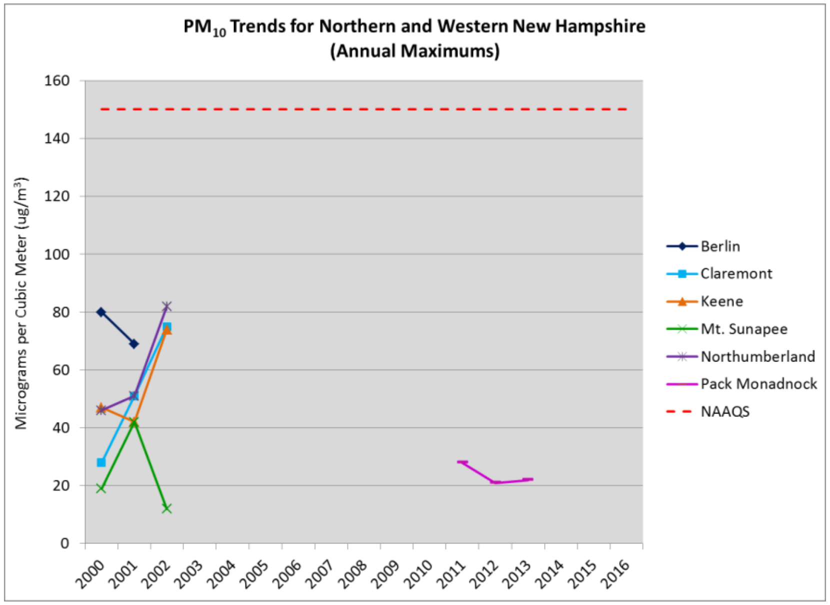


Figure 1.18: PM_{10} trends for the 24-hour NAAQS (2000-2016)



In 2016, New Hampshire operated two Photochemical Assessment Monitoring Stations (PAMS): Pack Monadnock and Londonderry. Tables 1.12 and 1.13 show that none of the toxic PAMS parameters are near their Ambient Allowable Limits (AAL) at either site. Benzene has the lowest AAL, 5.7 µg/m3. At Londonderry and Pack Monadnock, the maximum 24-hour averages for benzene over the full period were about 0.2 and 0.4 µg/m3, respectively, or about 4%-7% of the AAL. Maximum values for all the other parameters for both sites are consistently less than 1% of their AAL.

Table 1.8: New Hampshire State and Local Air Monitoring Stations Network – 2016/2017					
		SO_2			
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Londonderry	Moose Hill School	33 015 0018	Continuous	Regional	Population
Pembroke	Pembroke Highway Dept.	33 013 1006	Continuous	Neighborhood	High Concentration
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research
Portsmouth	Peirce Island	33 015 0014	Continuous	Neighborhood	Population
* Concord	Hazen Drive	33 013 1007	Continuous	Neighborhood	Population
* Discontinued on December 31, 2016					
		CO			
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Londonderry	Moose Hill School	33 015 0018	Continuous	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research
		O_3			
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Concord	Hazen Drive	33 013 1007	April - Sept	Neighborhood	Population
Greens Grant	Camp Dodge	33 007 4002	April - Sept	Regional	Research
Keene	Water Street	33 005 0007	Continuous	Neighborhood	Population
Laconia	Lakes Region	33 001 2004	April - Sept	Regional	Population
Lebanon	Lebanon	33 009 0010	Continuous	Regional	Population
Londonderry	Moose Hill School	33 015 0018	Continuous	Regional	Population
Mount Washington	Mt. Washington Summit	33 007 4001	Continuous	Regional	Research
Nashua	Gilson Road	33 011 1011	April - Sept	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research
Portsmouth	Peirce Island	33 015 0014	Continuous	Neighborhood	Population
Rye, Odiorne	Seacoast Science Center	33 015 0016	April - Sept	Neighborhood	High Concentration
		NO_2/NO_y			
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Londonderry NOy	Moose Hill School	33 015 0018	Continuous	Regional	Population
Londonderry NO_2	Moose Hill School	33 015 0018	Continuous	Regional	Population
Peterborough NOy	Pack Monadnock	33 011 5001	Continuous	Regional	Research

Table 1.9: New Hampshire Particulate Matter Network – 2016/2017					
$PM_{2.5}$					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Keene	Water Street	33 005 0007	1 in 12 filter	Neighborhood	Population
Keene	Water Street	33 005 0007	Continuous - BAM	Neighborhood	Population
Laconia	Green Street	33 001 2004	1 in 6 filter	Regional	Population
Laconia	Green Street	33 001 2004	1 in 6 filter	Regional	Colocate
Lebanon	Lebanon Airport	33 009 0010	1 in 12 filter	Neighborhood	Population
Lebanon	Lebanon Airport	33 009 0010	Continuous - BAM	Regional	Population
Londonderry	Moose Hill School	33 015 0018	1 in 3 filter	Regional	Population
Londonderry	Moose Hill School	33 015 0018	Continuous - BAM	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous - BAM	Regional	Research
Peterborough	Pack Monadnock	33 011 5001	1 in 3 filter	Regional	Research
Portsmouth	Peirce Island	33 015 0014	1 in 6 filter	Regional	Population
Portsmouth	Peirce Island	33 015 0014	Continuous - BAM	Regional	Population
$PM_{2.5}$ Speciation					
Peterborough	Pack Monadnock	33 011 5001	1 in 3 IMPROVE	Regional	Research
Londonderry	Moose Hill School	33 015 0018	1 in 3 IMPROVE	Regional	Population
PM_{10}					
Londonderry	Moose Hill School	33 015 0018	Continuous - BAM	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous - BAM	Regional	Research
* Portsmouth	Peirce Island	33 015 0014	1 in 6 filter	Neighborhood	Population
Portsmouth	Peirce Island	33 015 0014	1 in 6 filter	Neighborhood	Audit
Portsmouth	Peirce Island	33 015 0014	Continuous - BAM	Neighborhood	Audit
* Discontinued on December 31, 2016					

Table 1.10: New Hampshire PAMS Network – 2016/2017					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Londonderry	Moose Hill School	33 015 0018	Starting 2015 June - Sept	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	June - Sept	Regional	Research

Table 1.11: New Hampshire NCore Network – 2016/2017					
Town	**Name**	**AIRS #**	**Status**	**Scale**	**Objective**
Londonderry	Moose Hill School	33 015 0018	Operational on Jan 1, 2011	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Operational on Jan 1, 2011	Regional	Research

Table 1.12: Seasonal Maximum 24-hour Averages at Londonderry for Toxic PAMS Species Compared to the Ambient Allowable Limit (AAL), 2015-2016

		Max 24 Hr. Avg. (ug/m3)	Max 24 Hr. Avg. (ug/m3)	
PAMS Parameter	**AAL ug/m3**	**2015**	**2016**	**Max as % of AAL**
PROPYLENE (43205)	35,833	0.37	0.21	0.00%
CYCLOPENTANE (43242)	25,595	0.11	0.15	0.00%
ISOPENTANE (43221)	36,875	1.17	1.73	0.00%
PENTANE (43220)	36,875	0.59	0.73	0.00%
2-METHYLPENTANE (43285)	36,875	0.16	0.25	0.00%
3-METHYLPENTANE (43230)	36,875	0.16	0.29	0.00%
HEXANE (43231)	885	0.44	0.64	0.05%
BENZENE (45201)	6	0.53	0.27	9.26%
CYCLOHEXANE (43248)	6,000	0.12	0.18	0.00%
HEPTANE (43232)	8,249	0.18	0.44	0.00%
METHYLCYCLOHEXANE (43261)	23,958	0.12	0.24	0.00%
TOLUENE (45202)	5,000	1.11	1.65	0.02%
OCTANE (43233)	7,000	0.11	0.15	0.00%
ETHYLBENZENE (45203)	1,000	0.18	0.22	0.02%
M & P-XYLENES (45109)	1,550	0.51	0.61	0.03%
STYRENE (45220)	1,000	0.17	0.07	0.02%
O-XYLENE (45204)	1,550	0.20	0.21	0.01%
NONANE (43235)	15,625	0.13	0.11	0.00%
1,3,5-TRIMETHYLBENZENE (45207)	619	0.10	0.12	0.02%
1,2,4-TRIMETHYLBENZENE (45208)	619	0.21	0.27	0.03%

Table 1.13: Seasonal Maximum 24-hour Averages at Pack Monadnock in Miller State Park for Toxic PAMS Species Compared to the Ambient Allowable Limit (AAL), 2006-2016

		Max 24 Hour Avg. (ug/m3)											
PAMS Parameter	**AAL ug/m3**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Max as % of AAL**
PROPYLENE (43205)	35,833	0.28	0.25	0.46	0.15	0.20	0.59	0.38	0.17	0.16	0.28	0.29	0.00%
CYCLOPENTANE (43242)	25,595	0.42	0.53	1.63	0.29	0.09	0.17	0.21	0.13	0.13	0.23	0.11	0.01%
ISOPENTANE (43221)	36,875	1.03	1.09	0.70	0.89	0.75	1.84	2.32	0.95	0.73	0.96	0.68	0.01%
PENTANE (43220)	36,875	45.41	7.63	0.55	0.45	0.38	0.86	0.76	0.48	0.40	0.51	0.38	0.12%
2-METHYLPENTANE (43285)	36,875	0.19	0.27	0.04	0.06	0.04	0.30	0.25	0.06	0.07	0.12	0.07	0.00%
3-METHYLPENTANE (43230)	36,875	0.13	0.17	0.01	0.04	0.03	0.21	0.19	0.03	0.02	0.05	0.03	0.00%
HEXANE (43231)	885	0.21	0.27	0.19	0.32	1.36	1.01	0.48	0.28	0.24	0.40	0.16	0.15%
BENZENE (45201)	6	0.31	0.33	0.32	0.41	0.73	1.09	0.45	0.38	0.41	0.64	0.18	19.18%
CYCLOHEXANE (43248)	6,000	0.14	0.05	0.02	0.08	0.04	0.48	0.15	0.06	0.04	0.09	0.01	0.01%
HEPTANE (43232)	8,249	0.71	0.16	0.15	0.17	0.13	0.79	0.21	0.14	0.11	0.14	0.04	0.01%
METHYLCYCLOHEXANE (43261)	23,958	1.23	0.15	0.15	0.11	0.16	0.49	0.14	0.07	0.06	0.10	0.04	0.01%
TOLUENE (45202)	5,000	1.00	1.05	1.11	1.01	0.77	2.48	1.36	0.80	0.56	0.67	0.53	0.05%
OCTANE (43233)	7,000	0.91	0.17	0.27	0.11	0.06	0.40	0.23	0.07	0.04	0.02	0.02	0.01%
ETHYLBENZENE (45203)	1,000	0.35	0.20	0.59	0.21	0.15	0.42	0.18	0.13	0.07	0.08	0.05	0.06%
M & P-XYLENES (45109)	1,550	1.88	0.37	2.38	0.46	0.23	1.22	0.42	0.42	0.19	0.25	0.13	0.15%
STYRENE (45220)	1,000	1.03	1.13	1.80	0.40	0.08	0.18	0.14	0.05	0.18	0.04	0.03	0.18%
O-XYLENE (45204)	1,550	0.60	0.13	0.67	0.15	0.08	0.45	0.20	0.16	0.08	0.06	0.04	0.04%
NONANE (43235)	15,625	8.83	1.33	0.57	0.23	0.08	0.16	0.20	0.36	0.05	0.09	0.06	0.06%
1,3,5-TRIMETHYLBENZENE (45207)	619	1.75	0.08	0.29	0.13	0.04	0.10	0.12	0.08	0.01	0.09	0.01	0.28%
1,2,4-TRIMETHYLBENZENE (45208)	619	3.91	1.34	0.79	0.53	0.14	0.38	0.26	0.08	0.09	0.15	0.04	0.63%

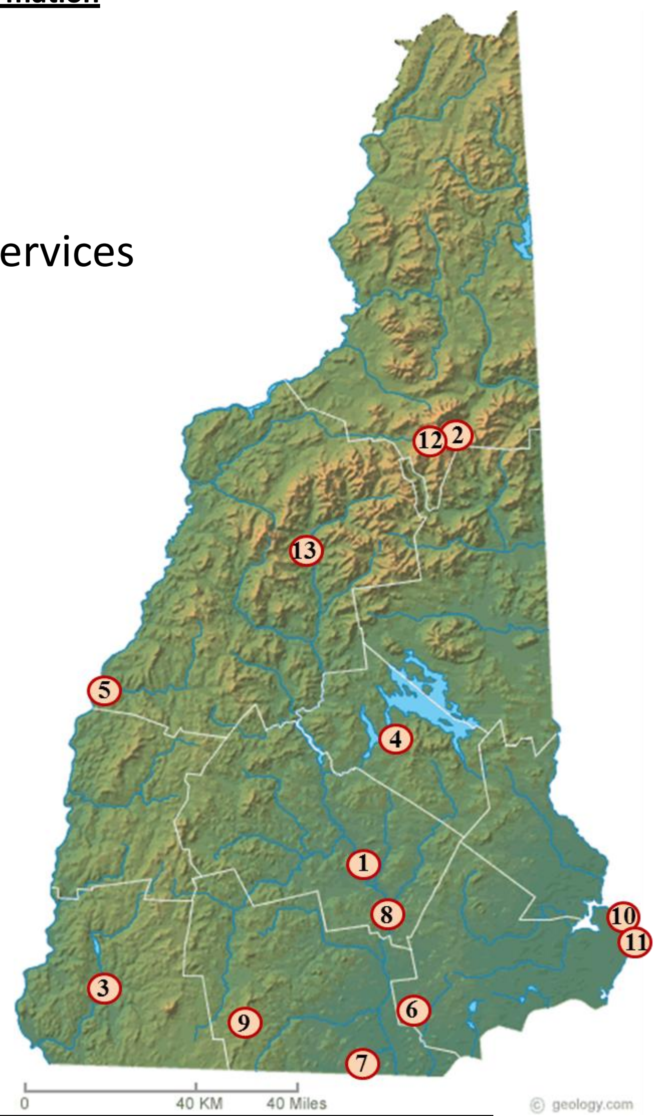
PART 2: Individual Station Information

New Hampshire
Department of Environmental Services

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Air Resources Division

Air Quality Monitoring Stations

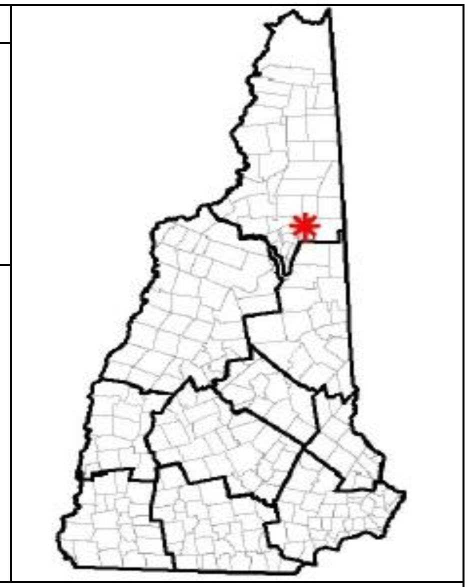


Summer 2017	Ncore	IMPROVE	CASTNET	NADP	PAMS	Laboratory	Carbon Monoxide (CO)	Nitrogen Dioxide (NO2)	Nitrogen Oxides (NOy)	Ozone (O3)	PM2.5	PM2.5 co-location	PM10	PM10 co-location	PM Coarse	Sulfur Dioxide (SO2)	Wind Direction (WD)	Wind Speed (WS)	External Temperature (ETP)	Barometric Pressure (BP)	Relative Humidity (RH)	Precipitation (PT)	Solar Rediation (SolRad)
1. Concord						●				●							●	●	●				
2. Greens Grant - Camp Dodge		●								●									●				
3. Keene										●	●						●	●	●				
4. Laconia										●	●	●					●	●	●			●	
5. Lebanon										●	●						●	●	●				
6. Londonderry	●	●			●		●	●	●	●	●		●		●	●	●	●	●	●	●	●	
7. Nashua										●							●	●	●				
8. Pembroke																●	●	●	●				
9. Peterborough - Pack Monadnock	●	●			●		●		●	●	●		●		●	●	●	●	●	●	●	●	●
10. Portsmouth										●	●		●	●		●	●	●	●				
11. Rye										●							●	●	●				
12. Sargents Purchase - Mt Washington Summit										●									●				
13. Woodstock - Hubbard Brook			●	●						●									●				

● proposed to be discontinued
● proposed to be added

Camp Dodge, Green's Grant

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-007-4002 Green's Grant Route 16 Coos Regional	Latitude: Longitude: Elevation (m): Year Est.:	44.308132 -71.217639 449 1995



Site Description

This air monitoring station is located in a rural forested area off Route 16 in Green's Grant. This wood clad, stick built shelter is approximately 7' wide by 10' long. This station is representative of a Class 1 Type Airshed. NHDES operates this station in cooperation with the Appalachian Mountain Club and the US Forest Service.

Pollutants/Parameters

Ozone – Temperature – IMPROVE. The US Forest Service operates the IMPROVE sampler.

Recent Changes

NHDES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future.

Mt. Washington Summit

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-007-4001 Sargents Purchase Yankee Bld. Coos Regional	Latitude: Longitude: Elevation (m): Year Est.:	44.270093 -71.303821 1,910 1990

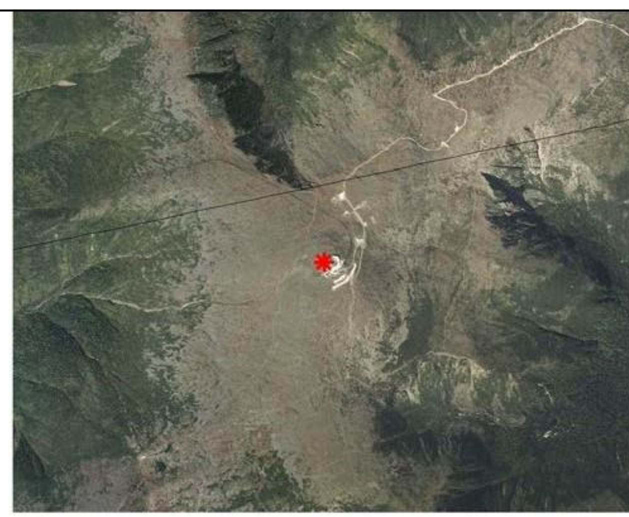
Site Description

This air monitoring station is located at the top of Mt. Washington in the Yankee Building.

Pollutants/Parameters
Ozone – Temperature

Recent Changes
NHDES did not make any significant changes to this station during this review period.

Proposed/Planned Changes
NHDES is not planning any significant changes to this station into the foreseeable future.



Hubbard Brook, Woodstock

General Information			
AQS ID:	33-009-8001	Latitude:	43.944544
Town:	Woodstock	Longitude:	-71.700772
Address:	Mirror Lake Rd.	Elevation (m):	250
County:	Grafton	Year Est.:	1989
Spatial Scale:	Regional		

Site Description

This air monitoring station is located in a rural area in the White Mountain National Forest. This pre-fabricated structure is specifically designed for climate-controlled scientific operations. It measures approximately 8' wide by 10' long. A USEPA Contractor operates this site.

Pollutants/Parameters

Ozone – Temperature – CASTNET

Recent Changes

NHDES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future.

Lebanon Airport, Lebanon

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-009-0010 Lebanon Airport Road Grafton Neighborhood	Latitude: Longitude: Elevation (m): Year Est.:	43.629605 -72.309499 171 2005

Site Description

This 8' wide by 10' long insulated trailer is located at the northeast edge of the Lebanon Municipal Airport in a commercial area. The filter based $PM_{2.5}$ sampler is located on a deck on top of the trailer.

Pollutants/Parameters

Ozone - Continuous $PM_{2.5}$ (BAM) – filter based $PM_{2.5}$ (1 every 12 days) - Wind Speed - Wind Direction - Temperature

Recent Changes

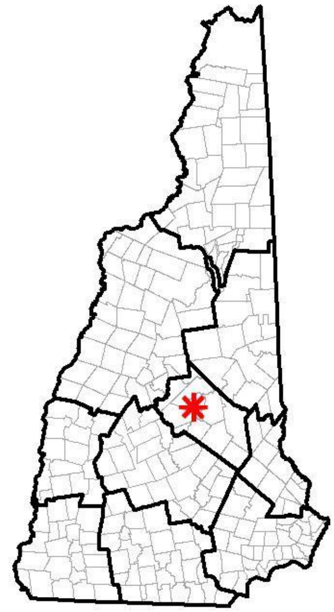
NHDES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future.

Green Street, Laconia

General Information			
AQS ID:	33-001-2004	Latitude:	43.566122
Town:	Laconia	Longitude:	-71.496335
Address:	Green Street	Elevation (m):	216
County:	Belknap	Year Est.:	2001
Spatial Scale:	Regional		



Site Description

This 10' wide by 12' long cedar clad, stick-built air monitoring station is located in an open field in a rural residential area. The filter-based $PM_{2.5}$ sampler is located on a platform approximately 30m from the structure.

Pollutants/Parameters

Ozone – filter based $PM_{2.5}$ (1 every 6 days) – Colocated filter based PM2.5 (1 every 6 days) –Wind Speed – Wind Direction – Temperature - Precipitation

Recent Changes

NHDES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

NHDES is planning to relocate this station to a more suitable location for $PM_{2.5}$ monitoring in-town Laconia. This would include the establishment of $PM_{2.5}$ BAM monitoring.

Hazen Station, Concord

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-013-1007 Concord 27 Hazen Dr. Merrimack Neighborhood	Latitude: Longitude: Elevation (m): Year Est.:	43.218470 -71.514525 107 2004

Site Description

This site has the advantage of being in close proximity to the NHDES main office, for both outreach opportunities and ease of maintenance. It is also in the proximity of residential neighborhoods, retirement communities and schools. The Station measures 8’ wide by 18’ long. Its insulated, box-type structure is specifically designed for climate-controlled scientific functions

Pollutants/Parameters

Ozone – Temperature – Wind Speed – Wind Direction. NHDES also uses this station as an air monitoring laboratory and a staging area for field-ready equipment.

Recent Changes

NHDES discontinued SO_2 monitoring in Concord on December 31, 2016.

Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future.

Exchange Street, Pembroke

General Information			
AQS ID:	33-013-1006	Latitude:	43.132460
Town:	Pembroke	Longitude:	-71.458246
Address:	Pleasant St.	Elevation (m):	74
County:	Merrimack	Year Est.:	2002
Spatial Scale:	Neighborhood		

Site Description

This station is located in a suburban residential area southeast of the coal burning Merrimack station power plant. It is the ideal location for improving our understanding of near-field emissions from the Merrimack Station power plant. This insulated, box-type structure is specifically designed for climate-controlled scientific functions and measures approximately 8’ wide by 10’ long.

Pollutants/Parameters

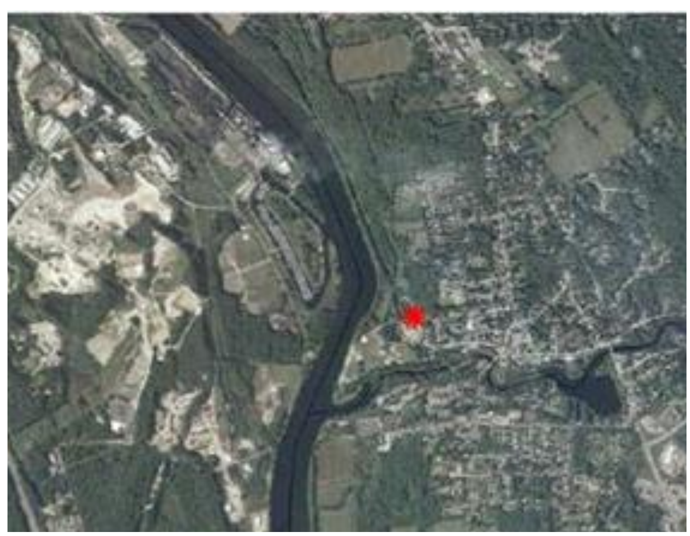
Sulfur Dioxide – Temperature – Wind Speed – Wind Direction.

Recent Changes

NHDES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future.



Peirce Island, Portsmouth

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-015-0014 Portsmouth Peirce Island Rockingham Neighborhood	Latitude: Longitude: Elevation (m): Year Est.:	43.075371 -70.748017 10 2001

Site Description

This station is located in an urban commercial/residential area. It is strategically position to capture air quality data from the Portsmouth Shipyard (northeast), the urban center of Portsmouth (southwest), the industrialized Piscataqua River (northwest) and ocean fetch-type events (southeast) depending on wind direction. The cedar clad, stick built shelter is approximately 10' wide by 12' long. Filter based $PM_{2.5}$ samplers are located on platforms approximately 8m from the shelter.

Pollutants/Parameters

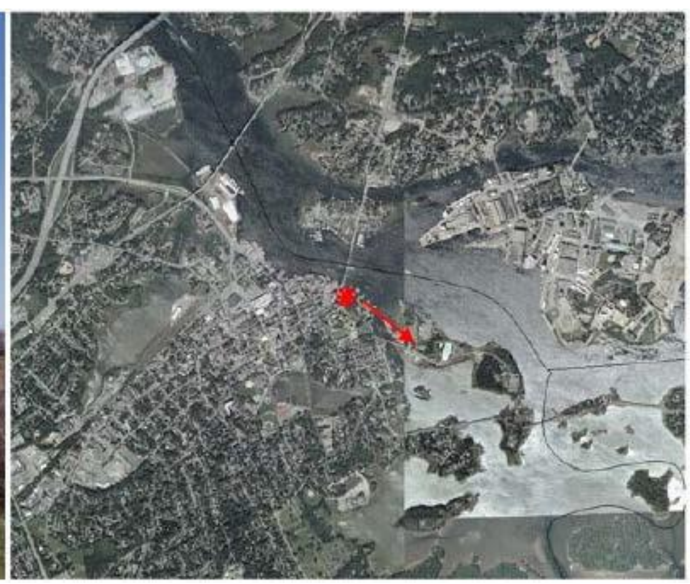
Ozone – $PM_{2.5}$ Continuous (BAM) – filter based $PM_{2.5}$ (1 every 12 days) – PM_{10} Continuous (BAM) – filter based PM_{10} (1 every 6 days) – filter based PM_{10} Colocation (1 every 6 days) – Sulfur Dioxide – Temperature – Wind Speed – Wind Direction

Recent Changes

NHDES discontinued filter based PM_{10} at this station on December 31, 2016. However NHDES will continue to operate one filter based PM_{10} on a 1 in12 day schedule as colocation for the PM_{10} BAM.

Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future.



Seacoast Science Center, Rye

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-015-0016 Rye Seacoast Science Ctr. Rockingham Neighborhood	Latitude: Longitude: Elevation (m): Year Est.:	43.045269 -70.713958 10 2003

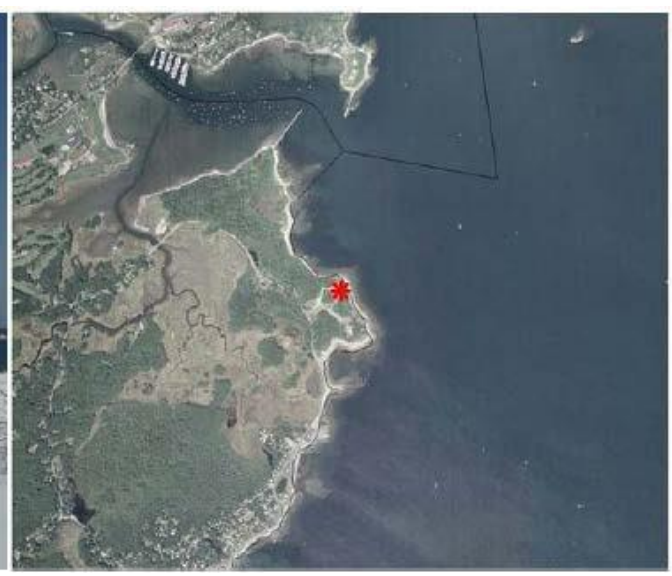
Site Description

This station is located in a rural neighborhood on the seacoast in direct exposure to the Atlantic Ocean. The station is located inside a modified corner of the main facility building at the Seacoast Science Center. NHDES established this station to measure coastal ozone episodes as well as to promote public understanding of air pollution and monitoring.

Pollutants/Parameters
Ozone - Temperature – Wind Speed – Wind Direction.

Recent Changes
NHDES did not make any significant changes to this station during this review period.

Proposed/Planned Changes
NHDES is not planning any significant changes to this station into the foreseeable future.



Water Street, Keene

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-005-0007 Keene Water Street Cheshire Neighborhood	Latitude: Longitude: Elevation (m): Year Est.:	42.930521 -72.272332 145 1989

Site Description

This 8' wide by 10' long air monitoring station is situated in a commercial area, close to the center of the city of Keene. The filter-based $PM_{2.5}$ sampler is located on the rooftop deck.

Pollutants/Parameters

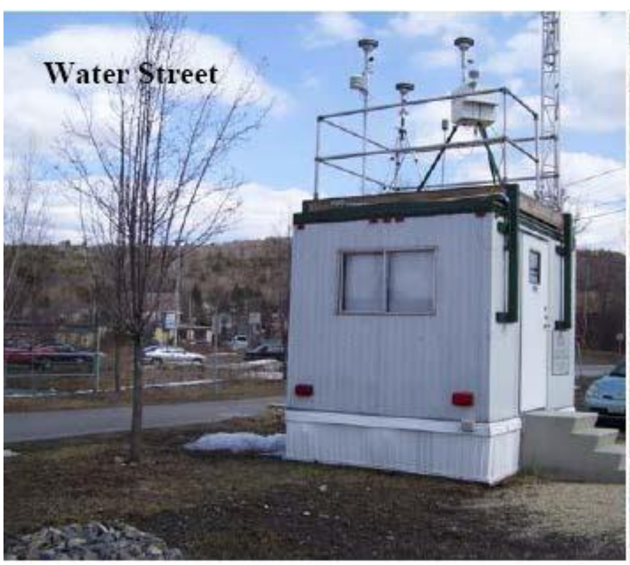
Ozone - $PM_{2.5}$ Continuous (BAM) – filter based $PM_{2.5}$ (1 every 12 days) – Wind Speed - Wind Direction - Temperature

Recent Changes

NHDES did not make any significant changes to this station during this review period.

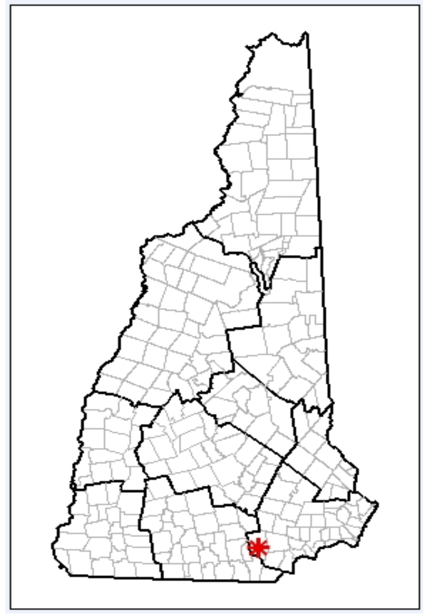
Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future.



Moose Hill, Londonderry

General Information			
AQS ID:	33-015-0018	Latitude:	42.862522
Town:	Londonderry	Longitude:	-71.380153
Address:	Moose Hill Sch.	Elevation (m):	104
County:	Rockingham	Year Est.:	2009
Spatial Scale:	Neighborhood		



Site Description

Proposed:

This 12’ wide by 16’ long wood clad, stick-built air monitoring station is located in a very open field in the heart of suburban New Hampshire, approximately halfway between the state’s two largest cities (Manchester and Nashua). It has virtually zero local interferences from nearby pollution sources or obstructions, making it an ideal location to measure regional air quality. Filter-based $PM_{2.5}$ samplers are located on platforms approximately 15 m from the structure.

Pollutants/Parameters

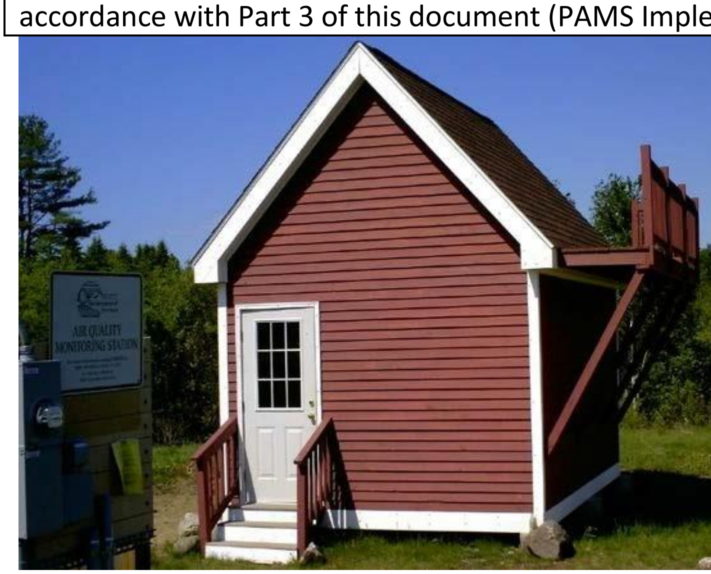
NCORE: $PM_{2.5}$ Continuous (BAM) – PM_{10} Continuous (BAM) - filter based $PM_{2.5}$ (1 every 3 days) – IMPROVE – PM Coarse (1 every 3 days) – Oxides of Nitrogen (NOy) – Nitrogen Dioxide (NO_2) – Ozone – Sulfur Dioxide (trace) – Carbon Monoxide (trace) – Temperature – Wind Speed – Wind Direction – Relative Humidity – Precipitation – Barometric Pressure – Photochemical Precursors.

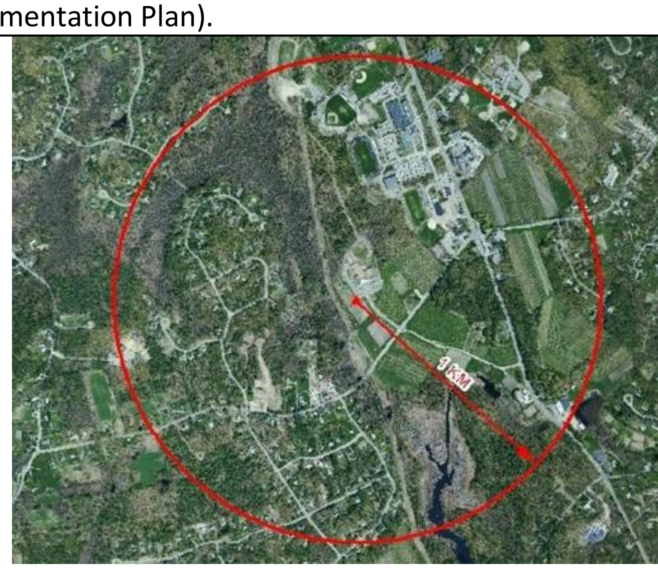
Recent Changes

NHDES discontinued lead monitoring in Londonderry on July 1, 2016. NHDES also replaced the filter based PM_{10} at this station with a PM_{10} BAM on July 1, 2016.

Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future, except in accordance with Part 3 of this document (PAMS Implementation Plan).





Pack Monadnock Mountain, Peterborough

General Information			
AQS ID:	33-011-5001	Latitude:	42.861830
Town:	Peterborough	Longitude:	-71.878626
Address:	Miller State Park	Elevation (m):	694
		Year Est.:	2002
County:	Hillsborough		
Spatial Scale:	Regional		

Site Description

This station is located in an elevated forest environment on the summit of Pack Monadnock Mountain. NHDES recently renovated this 27' by 10' structure to include many efficiency initiatives. The location of this station is scientifically significant because it is the highest accessible peak that lies directly within the primary air pollution transport corridor into the central part of the state. This allows this site to be the ideal location for improving our understanding of air pollution transport into the heavily populated Merrimack Valley and beyond. The filter based $PM_{2.5}$ sampler is located on a deck on top of the structure.

Pollutants/Parameters

NCORE: $PM_{2.5}$ Continuous (BAM) - filter based $PM_{2.5}$ (1 every 3 days) – IMPROVE – PM Coarse (1 every 3 days) – filter based PM_{10} (1 every 3 days) – Oxides of Nitrogen (NOy) – Ozone – Sulfur Dioxide (trace) – Carbon Monoxide (trace) – Temperature – Wind Speed – Wind Direction – Relative Humidity – Precipitation – Barometric Pressure – Solar Radiation – Photochemical Precursors.

Recent Changes

NHDES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future.

Gilson Road, Nashua

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-011-1011 Nashua 57 Gilson Rd. Hillsborough Neighborhood	Latitude: Longitude: Elevation (m): Year Est.:	42.718656 -71.522428 59 2003

Site Description

This air monitoring station is located in a suburban residential neighborhood near a Superfund site. NHDES requires two 8' wide by 16' long trailers to accommodate the equipment needed to measure ambient air parameters, including PAMS. NHDES collects meteorological data from a tower located on an adjacent building. Photochemical Assessment Monitoring (PAMS) was previously conducted at this station. NHDES moved PAMS to Londonderry in 2014. PAMS canister preparation still takes place at this station.

Pollutants/Parameters

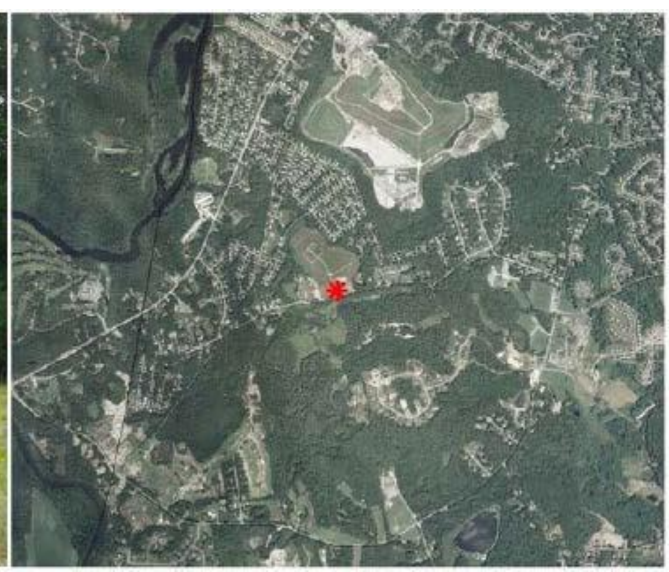
Ozone – Temperature – Wind Speed – Wind Direction.

Recent Changes

NHDES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

NHDES is not planning any significant changes to this station into the foreseeable future.



PART 3: PAMS Monitoring Implementation Network Plan
Monitoring Organizations Required To Operate At NCore Sites

The New Hampshire Department of Environmental Services (NHDES) operates two Photochemical Assessment Monitoring Stations (PAMS) sites in the air monitoring network as of 2016 at the Moose Hill School in Londonderry and Miller State Park in Peterborough, NH. The recently revised monitoring rule (80 FR 65292; October 26, 2015) requires PAMS measurements June 1 through August 31 at NCore sites that are located in Core-Based Statistical Areas (CBSAs) with populations of 1,000,000 or more.

Network Decision

X The NCore site located at Moose Hill School in Londonderry will serve as the location of the required PAMS site and will measure the following parameters described below. An inventory of equipment used at the site is provided in Table 2

☐ We request a waiver from implementing PAMS at an otherwise required NCore site entirely, or to make PAMS measurements at alternative locations such as existing PAMS sites or existing NATTS sites. Rationale for this waiver is provided in Waiver attachment

Auto GC Decision

Volatile organic compounds (VOCs) – A complete list of the targeted compounds are found in Table 1.

X We will measure hourly speciated VOC measurements with an auto-gas chromatograph (GC) using the Markes/Agilent System

☐ We request a waiver to allow three 8-hour samples every third day as an alternative to daily hourly speciated VOC measurements at locations. Rationale for this waiver is provided in Waiver Attachment

Meteorology Measurements Decision – Note: USEPA is suggesting the use of ceilometers for determining mixing height; however other types of meteorological equipment that provide for an indication of mixing height can be proposed

X We will measure wind direction, wind speed, temperature, humidity, atmospheric pressure, precipitation, solar radiation, ultraviolet radiation, and mixing height. We have elected to use the following instrumentation to measure the parameters described above:

UV Rad: Epply/TUVR
Sol Rad: LI-COR/LI-200
Wind Speed/Wind Direction: Met One/590,591
Rain Gauge: Met One/370
Humidity/Temperature: Met One/083D-1-35
Barometric Pressure: Met One/ BAM 1020
Mixing Height: Vaisala/CL-51

☐ We request a waiver to allow meteorological measurements to be obtained from other nearby sites. Rationale for this waiver is provided in waiver attachment

Other Required Measurements

- **Carbonyls -** Carbonyl sampling at a frequency of three 8-hour samples on a one-in-three day basis (~90 samples per PAMS sampling season) using an Atec Model 8000 and subbing samples to Eastern Research Group (ERG) for analysis. A complete list of the target carbonyl compounds may be found in Table 1. The TO-11A test method, as used in the National Air Toxics Trends (NATTS) program[1] will be used.
- **Nitrogen Oxides –** Will monitor for NO and NO_y (total oxides of nitrogen) in addition to true NO_2. The true NO_2 is required to be measured with a direct reading NO_2 analyzer, cavity attenuated phase shift (CAPS) analyzer. We have elected to use a Teledyne (TAPI) Model T500U for the true NO_2 measurement. NO and NOy will be measured using an Ecotech EC9843.

Table 1: PAMS Target Compound List

Priority Compounds				Optional Compounds			
1	1,2,3-trimethylbenzene [a]	19	n-hexane [b]	1	1,3,5-trimethylbenzene	19	m-diethlybenzene
2	1,2,4-trimethylbenzene [a]	20	n-pentane	2	1-pentene	20	methylcyclohexane
3	1-butene	21	o-ethyltoluene [a]	3	2,2-dimethylbutane	21	methylcyclopentane
4	2,2,4-trimethylpentane [b]	22	o-xylene [a,b]	4	2,3,4-trimethylpentane	22	n-decane
5	acetaldehyde [b,c]	23	p-ethyltoluene [a]	5	2,3-dimethylbutane	23	n-heptane
6	acetone [c,d]	24	Propane	6	2,3-dimethylpentane	24	n-nonane
7	benzene [a,b]	25	propylene	7	2,4-dimethylpentane	25	n-octane
8	c-2-butene	26	styrene [a,b]	8	2-methylheptane	26	n-propylbenzene [a]
9	ethane [d]	27	toluene [a,b]	9	2-methylhexane	27	n-undecane
10	ethylbenzene [a,b]	28	t-2-butene	10	2-methylpentane	28	p-diethylbenzene
11	Ethylene			11	3-methylheptane	29	t-2-pentene
12	formaldehyde [b,c]			12	3-methylhexane	30	α/β-pinene
13	Isobutane			13	3-methylpentane	31	1,3 butadiene [b]
14	Isopentane			14	Acetylene	32	benzaldehyde [c]
15	Isoprene			15	c-2-pentene	33	carbon tetrachloride [b]
16	m&p-xylenes [a,b]			16	cyclohexane	34	Ethanol
17	m-ethyltoluene [a]			17	cyclopentane	35	Tetrachloroethylene [b]
18	n-butane			18	isopropylbenzene [b]		

Source: Revisions to the Photochemical Assessment Monitoring Stations Compound Target List. US EPA, November 20, 2013

[a] Important SOAP (Secondary Organic Aerosols Precursor) Compounds
[b] HAP (Hazardous Air Pollutant) Compounds
[c] Carbonyl compounds
[d] Non-reactive compounds, not considered to be VOC for regulatory purposes

[1] See NATTS Technical Assistance Document for TO-11A method.

Table 2: Inventory of Equipment at Londonderry NCore site

Parameter	Category	Detail
Site	Is the AQS site ID listed above the expected PAMS Core site location?	Yes
	What is the status of the decision for the expected PAMS Core site location (not started, draft, or final)?	Final
	Is there an alternate PAMS Core site location selected?	No
	Identify type of alternative site (existing PAMS, NATTS, etc)	Existing PAMS
	Alternate site AQS ID (if known)	
Mixing Height	Is there an existing functional ceilometer or other similar instrument available for use?	No
	current location (at future PAMS Core site, at other site, not applicable)	N/A
	instrument type (ceilometer, radar profiler, etc)	
	manufacturer	
	model	
	date purchased	
	comments	
Auto GC	Is there an existing Auto GC available for use?	Yes
	current location (at future PAMS Core site, at other site, not applicable)	PAMS NCORE site 33-015-0018
	manufacturer	PerkinElmer
	model	Clarus 500/TM100
	date purchased	2006/2007
	Does it have a service contract?	Yes
	Do you currently have auto GC components (such a preconcentrator) that you plan to use at the Required PAMS site?	H2 generator, TOC generator will both need upgrades/refurbishment
	manufacturer	Parker Balston
	model	
	date purchased	2006
	preference for auto-GC model	Markes-Agilent (FID)
	comments	
Data Acquisition System (DAS)	Is there an existing DAS available for use?	Agilaire
	current location (at future PAMS Core site, at other site, not applicable)	NCORE PAMS Site
	DAS type (standalone, integrated, other)	
	manufacturer	Agilaire
	model	ESC8872
	date purchased	16-May
	comments	
True NO2	Is there an existing true NO2 instrument available for use?	No
	current location (at future PAMS Core site, at other site, not applicable)	N/A
	instrument type (photolytic conversion, cavity ringdown, CAPS, etc)	
	manufacturer	
	model	
	date purchased	
	comments	
Carbonyls Sampling	Is there an existing sequential carbonyls sampling unit or similar instrument a	No
	current location (at future PAMS Core site, at other site, not applicable)	N/A
	manufacturer	
	model	
	date purchased	
	comments	
Carbonyls Analysis	Does the site currently have a support laboratory for carbonyls or plans to use a support laboratory?	Plan to sub out
	laboratory name	ERG
	comments	
Barometric Pressure	instrument type (aneroid barometer, etc)	MetOne BAM 1020
	manufacturer	MetOne
	model	MetOne BX-596
	date purchased	2016
	comments	
UV Radiation	instrument type (UV radiometer, etc)	Radiometer
	manufacturer	Eppley
	model	TUVR
	date purchased	2006
	comments	
Solar Radiation	instrument type (pyranometer, etc)	Pyranometer
	manufacturer	LI-COR
	model	LI-200
	date purchased	2013
	comments	
Precipitation	instrument type (tipping bucket, weighing, etc)	Tipping Bucket
	manufacturer	Met One
	model	370
	date purchased	2003
	comments	

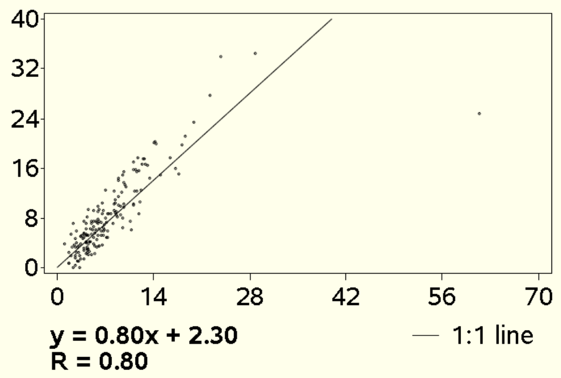
APPENDIX A:
$PM_{2.5}$ Comparability Assessments

$PM_{2.5}$ Continuous Monitor Comparability Assessment

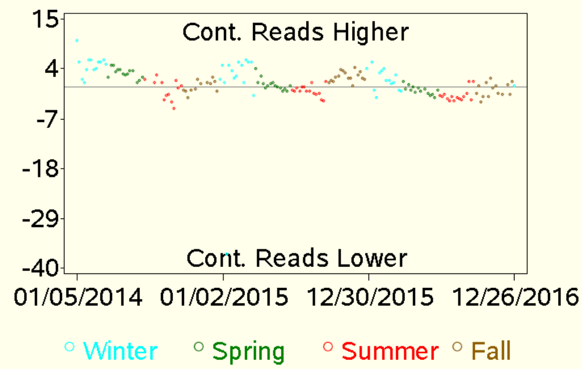
Site 33-005-0007: Keene, NH

FRM: BGI Models PQ200-VSCC or PQ200A-VSCC - Gravimetric (142,116), PM2.5 - Local Conditions (88101), POC=1
Cont: Met One BAM-1020 Mass Monitor w/VSCC - Beta Attenuation (170), PM2.5 - Local Conditions (88101), POC=3

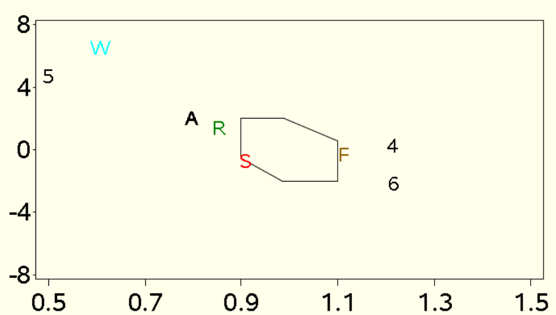
Cont. (y) vs. FRM (x) $PM_{2.5}$ ($\mu g/m^3$)



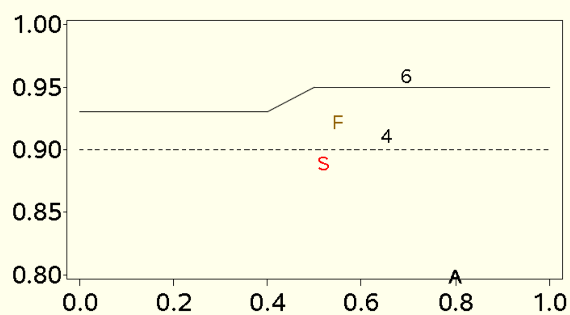
Cont. minus FRM $PM_{2.5}$ ($\mu g/m^3$)



Additive (y) vs. Multiplicate (x) Bias



R (y) vs. FRM CCV (x)



Mean $PM_{2.5}$ ($\mu g/m^3$)

Dataset	N	FRM	Cont	Ratio (Cont/FRM)
AllData	**170**	**7.7**	**8.4**	**1.10**
Winter	43	11.5	13.8	1.20
Spring	43	5.2	6.1	1.18
Summer	42	6.9	5.8	0.84
Fall	42	7.0	7.7	1.11
2014	53	7.4	9.5	1.28
2015	60	8.6	9.3	1.08
2016	57	6.9	6.4	0.93

Appendix A Statistics

Dataset	N (all observations)	Bias (all observations)	N (only >= 3 ug/m^3)	Bias (only >= 3 ug/m^3)
AllData	**170**	**11.5**	**138**	**14.9**
Winter	43	24.3	39	32.4
Spring	43	28.5	34	15.8
Summer	42	-17	31	-9.1
Fall	42	9.4	34	15.7
2014	53	36.8	44	29.8
2015	60	14.7	54	16.6
2016	57	-16	40	-3.9

Data Source: EPA AQS Data Mart

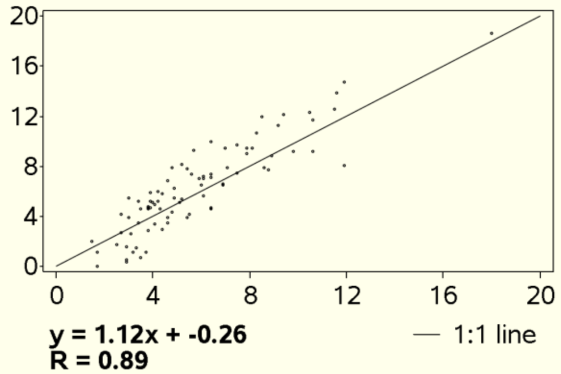
Generated on: April 19, 2017

PM 2.5 Continuous Monitor Comparability Assessment

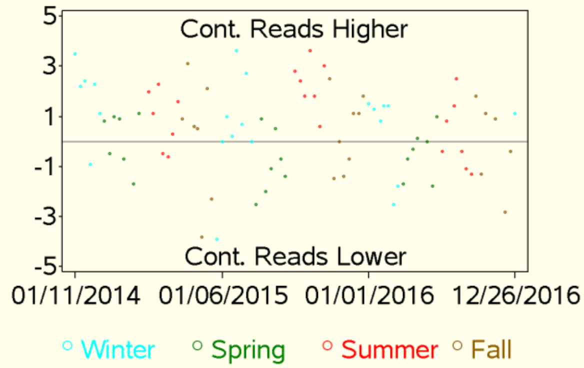
Site 33-009-0010: Lebanon, NH

FRM: BGI Models PQ200-VSCC or PQ200A-VSCC - Gravimetric (142,116), PM2.5 - Local Conditions (88101), POC=1
Cont: Met One BAM-1020 Mass Monitor w/VSCC - Beta Attenuation (170), PM2.5 - Local Conditions (88101), POC=3

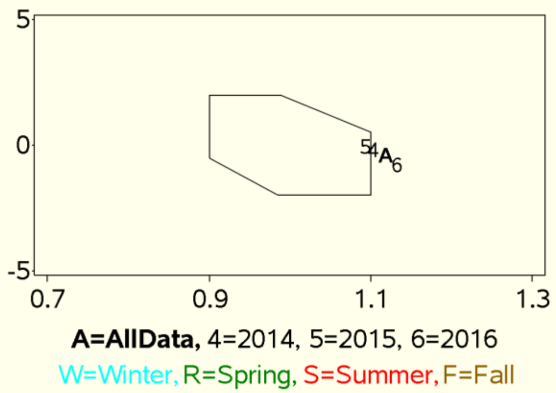
Cont. (y) vs. FRM (x) $PM_{2.5}$ ($\mu g/m^3$)



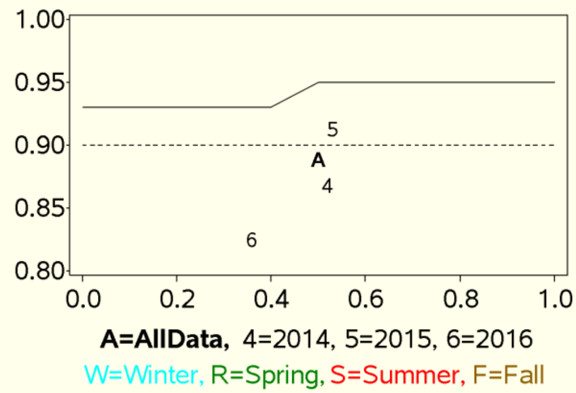
Cont. minus FRM $PM_{2.5}$ ($\mu g/m^3$)



Additive (y) vs. Multiplicate (x) Bias



R (y) vs. FRM CCV (x)



Mean $PM_{2.5}$ ($\mu g/m^3$)

Dataset	N	FRM	Cont	Ratio (Cont/FRM)
AllData	**85**	**5.8**	**6.2**	**1.07**
Winter	22	5.4	6.3	1.15
Spring	21	4.8	4.4	0.91
Summer	21	7.5	8.7	1.15
Fall	21	5.4	5.5	1.03
2014	28	5.7	6.2	1.09
2015	29	6.6	7.3	1.11
2016	28	5.1	5.1	1.00

Appendix A Statistics

Dataset	N (all observations)	Bias (all observations)	N (only >= 3 ug/m^3)	Bias (only >= 3 ug/m^3)
AllData	**85**	**4.4**	**69**	**15.6**
Winter	22	9.0	16	25.4
Spring	21	-12	17	1.6
Summer	21	16.7	20	18.4
Fall	21	3.5	16	17.0
2014	28	6.6	22	19.0
2015	29	9.2	25	17.8
2016	28	-2.9	22	9.6

Data Source: EPA AQS Data Mart

Generated on: April 19, 2017

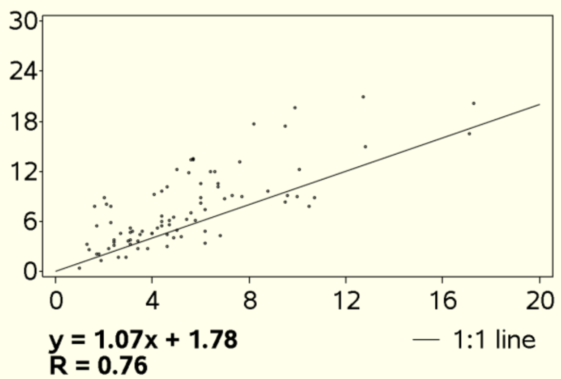
Londonderry 1

PM 2.5 Continuous Monitor Comparability Assessment

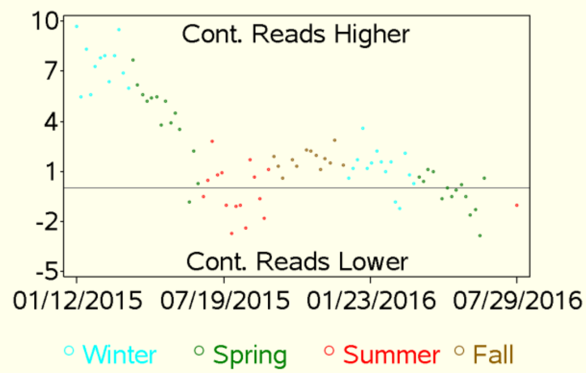
Site 33-015-0018: Not in a City, NH

FRM: R & P Model 2025 PM-2.5 Sequential Air Sampler w/VSCC - Gravimetric (145,142,), PM2.5 - Local Conditions (88101), POC=1
Cont: Met-one BAM-1020 W/PM2.5 SCC - Beta Attenuation (170), Acceptable PM2.5 AQI & Speciation Mass (88502), POC=3

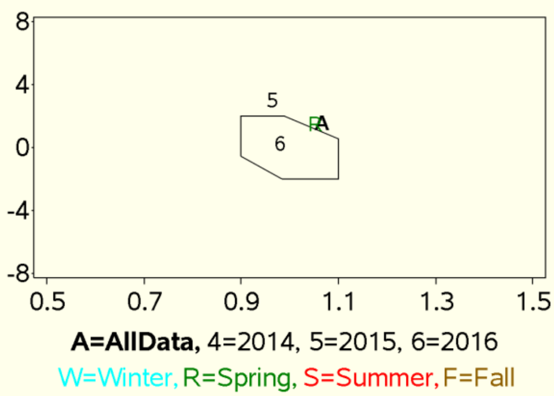
Cont. (y) vs. FRM (x) $PM_{2.5}$ ($\mu g/m^3$)



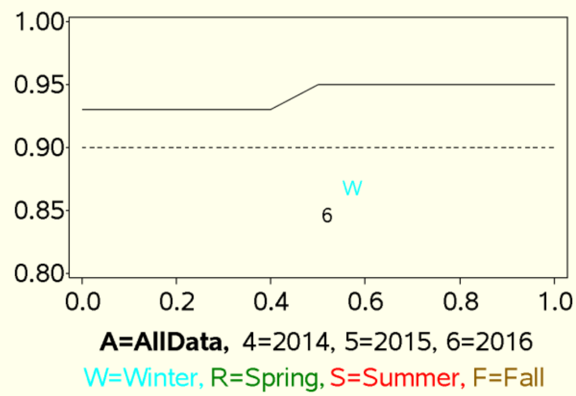
Cont. minus FRM $PM_{2.5}$ ($\mu g/m^3$)



Additive (y) vs. Multiplicate (x) Bias



R (y) vs. FRM CCV (x)



Mean $PM_{2.5}$ ($\mu g/m^3$)

Dataset	N	FRM	Cont	Ratio (Cont/FRM)
AllData	**84**	**5.4**	**7.5**	**1.40**
Winter	27	5.2	9.1	1.76
Spring	28	4.6	6.6	1.42
Summer	16	8.1	7.8	0.97
Fall	13	4.2	5.9	1.40
2014	0	.	.	.
2015	55	6.0	9.0	1.51
2016	29	4.3	4.7	1.10

Appendix A Statistics

Dataset	N (all observations)	Bias (all observations)	N (only >= 3 ug/m^3)	Bias (only >= 3 ug/m^3)
AllData	**84**	**52.3**	**63**	**38.5**
Winter	27	81.2	19	70.6
Spring	28	54.7	22	35.2
Summer	16	0.0	14	-0.2
Fall	13	51.5	8	39.2
2014	0	.	.	.
2015	55	73.0	43	50.6
2016	29	13.0	20	12.5

Data Source: EPA AQS Data Mart

Generated on: April 19, 2017

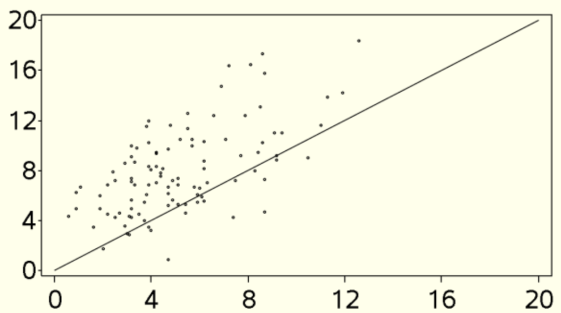
Londonderry 2

PM 2.5 Continuous Monitor Comparability Assessment

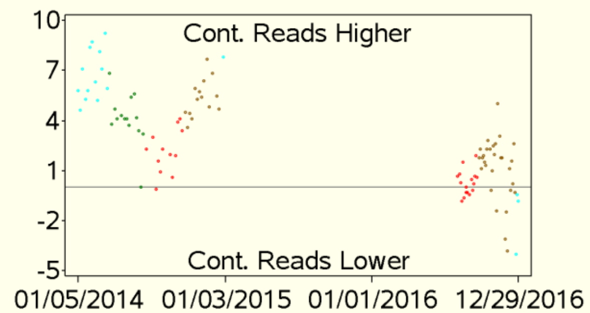
Site 33-015-0018: Not in a City, NH

FRM: R & P Model 2025 PM-2.5 Sequential Air Sampler w/VSCC - Gravimetric (145,142,), PM2.5 - Local Conditions (88101), POC=1
Cont: Met One BAM-1020 Mass Monitor w/VSCC - Beta Attenuation (170), PM2.5 - Local Conditions (88101), POC=3

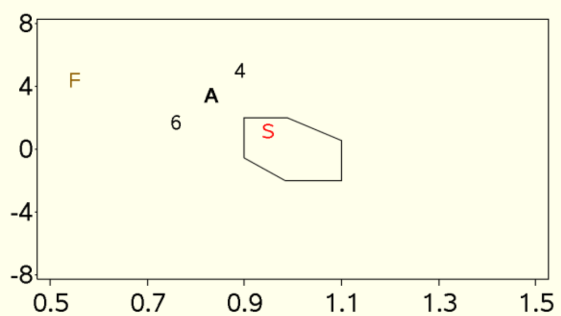
Cont. (y) vs. FRM (x) $PM_{2.5}$ ($\mu g/m^3$)



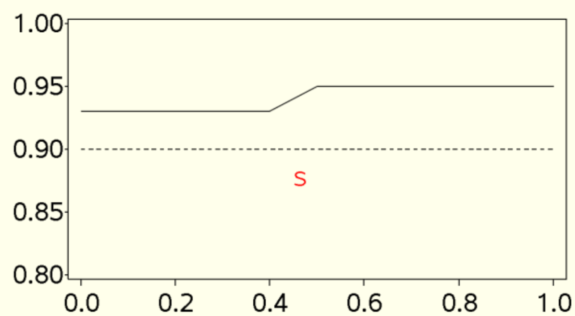
Cont. minus FRM $PM_{2.5}$ ($\mu g/m^3$)



Additive (y) vs. Multiplicate (x) Bias



R (y) vs. FRM CCV (x)



Mean $PM_{2.5}$ ($\mu g/m^3$)

Dataset	N	FRM	Cont	Ratio (Cont/FRM)
AllData	**102**	**5.2**	**8.0**	**1.54**
Winter	17	6.6	11.9	1.80
Spring	14	3.8	7.9	2.08
Summer	28	5.7	6.8	1.19
Fall	43	4.8	7.3	1.53
2014	54	5.2	9.9	1.91
2015	0	.	.	.
2016	48	5.2	5.9	1.13

Appendix A Statistics

Dataset	N (all observations)	Bias (all observations)	N (only >= 3 ug/m^3)	Bias (only >= 3 ug/m^3)
AllData	**102**	**84.3**	**84**	**58.3**
Winter	17	86.5	17	86.5
Spring	14	199	10	97.9
Summer	28	28.7	24	18.9
Fall	43	82.1	33	60.5
2014	54	139	45	94.4
2015	0	.	.	.
2016	48	23.1	39	16.7

Data Source: EPA AQS Data Mart

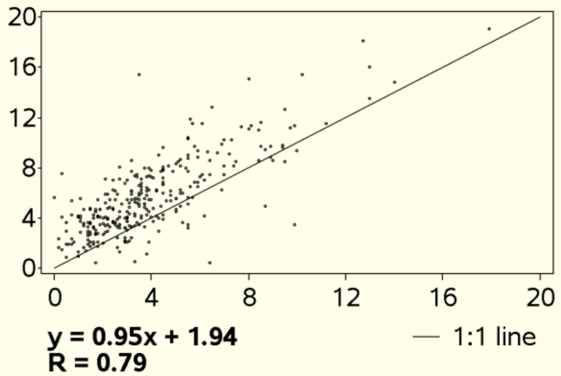
Generated on: April 19, 2017

$PM_{2.5}$ Continuous Monitor Comparability Assessment

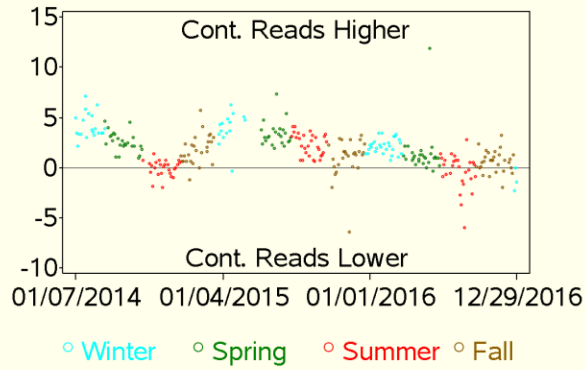
Site 33-011-5001: Peterborough (Peterboro), NH

FRM: R & P Model 2025 PM-2.5 Sequential Air Sampler w/VSCC - Gravimetric (145,118,), PM2.5 - Local Conditions (88101), POC=1
Cont: Met One BAM-1020 Mass Monitor w/VSCC - Beta Attenuation (170), PM2.5 - Local Conditions (88101), POC=3

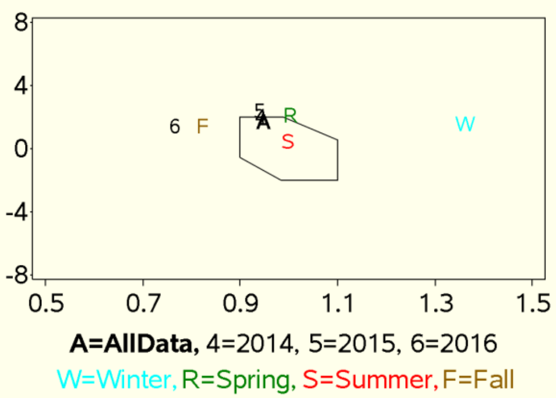
Cont. (y) vs. FRM (x) $PM_{2.5}$ ($\mu g/m^3$)



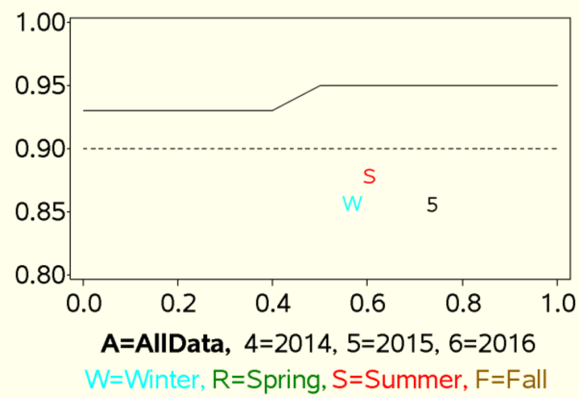
Cont. minus FRM $PM_{2.5}$ ($\mu g/m^3$)



Additive (y) vs. Multiplicate (x) Bias



R (y) vs. FRM CCV (x)



Mean $PM_{2.5}$ ($\mu g/m^3$)

Dataset	N	FRM	Cont	Ratio (Cont/FRM)
AllData	**309**	**3.9**	**5.6**	**1.45**
Winter	67	3.5	6.5	1.88
Spring	76	3.4	5.7	1.71
Summer	84	5.5	6.2	1.13
Fall	82	3.0	4.1	1.37
2014	102	4.0	6.1	1.52
2015	94	4.3	6.7	1.55
2016	113	3.3	4.2	1.27

Appendix A Statistics

Dataset	N (all observations)	Bias (all observations)	N (only >= 3 ug/m^3)	Bias (only >= 3 ug/m^3)
AllData	**309**	**82.3**	**176**	**41.8**
Winter	67	110	35	77.1
Spring	76	162	45	58.1
Summer	84	11.4	59	19.7
Fall	82	58.6	37	24.0
2014	102	74.3	63	49.4
2015	94	125	58	50.0
2016	113	53.5	55	24.6

Data Source: EPA AQS Data Mart

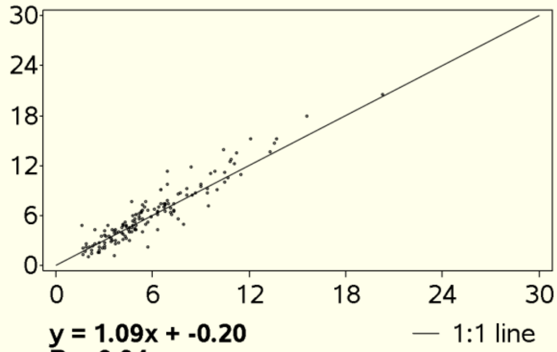
Generated on: April 19, 2017

PM 2.5 Continuous Monitor Comparability Assessment

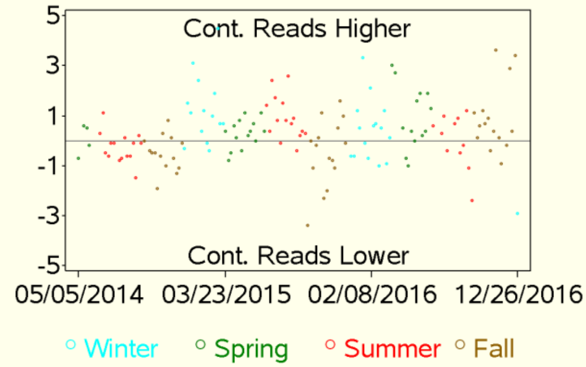
Site 33-015-0014: Portsmouth, NH

FRM: BGI Models PQ200-VSCC or PQ200A-VSCC - Gravimetric (142,116,), PM2.5 - Local Conditions (88101), POC=1
Cont: Teledyne Model 602 Beta plus w/VSCC - Beta Attenuation (204), PM2.5 - Local Conditions (88101), POC=6

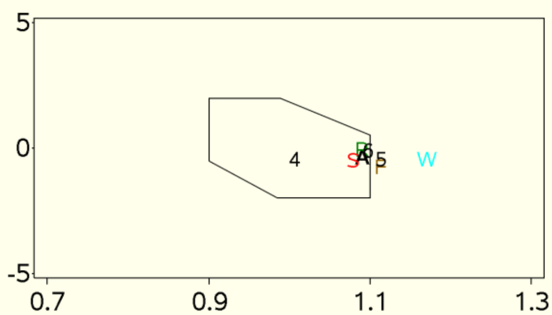
Cont. (y) vs. FRM (x) $PM_{2.5}$ ($\mu g/m^3$)



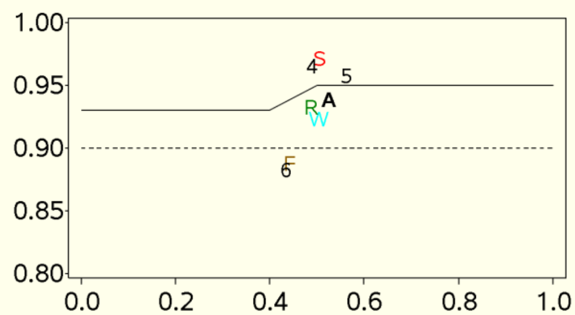
Cont. minus FRM $PM_{2.5}$ ($\mu g/m^3$)



Additive (y) vs. Multiplicate (x) Bias



R (y) vs. FRM CCV (x)



Mean $PM_{2.5}$ ($\mu g/m^3$)

Dataset	N	FRM	Cont	Ratio (Cont/FRM)
AllData	**146**	**5.9**	**6.2**	**1.05**
Winter	30	5.8	6.5	1.12
Spring	31	4.7	5.2	1.11
Summer	41	7.5	7.7	1.03
Fall	44	5.3	5.2	1.00
2014	35	5.5	5.3	0.95
2015	57	6.6	7.1	1.07
2016	54	5.2	5.8	1.11

Appendix A Statistics

Dataset	N (all observations)	Bias	N (only >= 3 ug/m^3)	Bias
AllData	**146**	**5.1**	**118**	**7.1**
Winter	30	13.9	24	11.0
Spring	31	11.8	24	11.6
Summer	41	1.8	38	3.8
Fall	44	-2.5	32	4.8
2014	35	-5.5	27	-4.5
2015	57	5.0	48	8.4
2016	54	12.1	43	13.0

Data Source: EPA AQS Data Mart

Generated on: April 19, 2017