THE NEW HAMPSHIRE AMBIENT AIR MONITORING PROGRAM 2012/2013 ANNUAL NETWORK REVIEW & PLAN

July 2012

New Hampshire Department of Environmental Services

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

R-ARD-10-1

THE NEW HAMPSHIRE AMBIENT AIR MONITORING PROGRAM 2012/2013 ANNUAL NETWORK REVIEW & PLAN

prepared by

the

Air Monitoring Program

State of New Hampshire
Department of Environmental Services
Air Resources Division
29 Hazen Drive
Concord, NH 033020095
(603) 271-3503
www.des.nh.gov

Table of Contents

List of Tables

List of Figures

Acknowledgements

DES would like to thank the United States Environmental Protection Agency (EPA) for their continued grant funding and staff support for efforts to operate, maintain, and improve New Hampshire's Air Monitoring Network. Special thanks to Alan VanArsdale, Robert Judge and Chris St. Germain for their continued help and support with air monitoring in New Hampshire. DES would also like to acknowledge the efforts of the following individuals for their dedication and efforts to operate New Hampshire's network and collect quality data in all types of conditions, data analysis, and contributions to this report;

- Jessica Sheldon for her steadfast work analyzing AMP data, using Assessment Tools, and her review of and contribution to preparation of this report.
- Thanks to all staff of the AMP including Tim Verville, Jim Poisson, Tom Fazzina, Craig Thoroughgood, Mike Little, Scott Klose, Lara Stumpo and Kendall Perkins for overall program operations.
- Dr. Jeff Underhill for overall program technical analysis and supervision and review of this report

Introduction

The New Hampshire Department of Environmental Services (DES) respectfully submits this 2012/2013 Ambient Air Monitoring Program Annual Network Review Plan in accordance with the *Code of Federal Regulations Title 40, PART 58.* DES would like to thank the United States Environmental Protection Agency (EPA) for their continued support with improving and maintaining New Hampshire's Air Monitoring Network. Part 1 of this Plan reviews structure, objectives, history and data trends associated with DES' Air Monitoring Program (AMP). Part 2 of this Plan details individual air monitoring station information.

Part 1: 2012/2013 Annual Network Review and Plan

As part of ongoing efforts to improve performance and maximize network efficiency within constrained resources, DES has affected a number of changes to the network over this report period (as detailed in Network Modifications of this Part 1). 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, and
- protect public health through real-time mapping and air pollution alert initiatives.

DES continually revisits and stresses basic air monitoring fundamentals and efficiency initiatives to allow for reliable, high quality data capture and analysis. Tables 1.7 through 1.10 at the end of this section summarize the current status of the New Hampshire ambient air monitoring network – July 2011 through June 2012.

Monitoring Objectives

In accordance with its mission "to help sustain a high quality of life for all citizens by protecting and restoring the environment and public health in New Hampshire", DES 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), and particulate matter (PM, $PM_{2.5}$, PM_{10}). Air monitoring data from DES' network not only helps assess air quality within New Hampshire but also helps evaluate the status of air quality coming from areas upwind. These data allow DES 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, and grew to where each of the state's ten counties hosted monitoring stations for air pollutants known to exist in the area. Over time, facilities 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 a reduced need for monitoring in the area. Accordingly, DES has reallocated monitoring resources. However, DES 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, DES has coordinated with EPA in reducing the number of individual monitoring stations in order to meet demands for ever increasing network efficiency with limited resources. DES 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. In 2011, the network increased by one station with the addition of a new super station in suburban Londonderry as part of a National Core Monitoring Network (NCore). This station was carefully selected to be representative of typical New Hampshire population in a suburban portion of the state that is heavily populated, growing, and where historical monitoring has demonstrated periodic events of unhealthy air quality.

The current New Hampshire ambient air monitoring network is carefully configured 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. DES also considered topography, geographic coverage, and air pollution modeling in the current network design.

Now, in 2012, 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 include ozone, ozone precursors (nitrogen oxides (NOx) and VOCs), $PM_{2.5}$ and SO_2. The monitoring network is most dense in this region to reflect these air quality concerns and the dense population. While the greatest risk of unhealthy air quality occurs in the southeastern 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 (pristine) airsheds located adjacent to Mt. Washington in northern New Hampshire.

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 DES felt that the nitrogen oxides emitted by the high volume of interstate traffic at freeway speeds would create a bubble of NOx scavenging, effectively lowering the measured ozone levels in the immediate area. This site has the advantage of being in close proximity to the DES main office, for both outreach opportunities and ease of maintenance. It is also in the proximity of residential neighborhoods, retirement communities and schools. DES 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 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. This monitoring location is also important since it represents two federally recognized Class I airsheds which also require IMPROVE visibility monitoring. DES tracks $PM_{2.5}$ levels estimated by IMPROVE for the purpose of estimating current exposures and the demand for more comprehensive $PM_{2.5}$ monitoring. DES 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. Currently, ozone poses the highest risk for an unhealthy air event in the North Country. This research oriented station represents population exposure on a regional scale.

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, DES is concerned about $PM_{2.5}$ levels at this station, especially during the winter months. DES 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, and 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.

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.

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 primarily chosen to represent the regional exposure, and the station is important to the New Hampshire network for its geographic coverage.

Londonderry

The Londonderry station came online January 1, 2011 as an NCore super station measuring a wide selection of pollutants. DES worked closely with EPA 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. 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 represents population exposure on a regional scale.

Manchester

DES shut this station down after the 1st quarter of 2012. The Manchester station was located in a parking lot in the urban center of the city. DES and EPA agreed to shutdown this station in accordance with the past two Annual Network Plans; however DES opted to keep it operational for a time for specific pollutant trend analysis.

While ozone in the city occasionally exceeded the NAAQS, the urban location is NOx rich and scavenges (reduces) measured ozone levels within the downtown area. The location often measured lower ozone levels than seen at nearby Londonderry, Nashua and Concord. The new nearby NCore station in Londonderry, which represents the Manchester suburbs where there is less NOx, is expected to show higher ozone levels than seen in Manchester and will thus be more protective.

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 6288 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.

Nashua – Crown Street

The Crown Street monitoring station represents urban $PM_{2.5}$ within the city of Nashua. This station will continue to track urban population-based $PM_{2.5}$.

Nashua – Gilson Road

In recent years, the Nashua area has often seen the highest ozone concentrations in the state and there is an ongoing need to continue tracking ozone in this area. The Gilson Road monitoring station also includes photochemical assessment monitoring (PAMS), which measures important precursors to the development of ozone. These precursors include a wide variety of volatile organic compounds and nitrogen oxides. 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 also pairs with the Pack Monadnock 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.

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

Pack Monadnock station is the state's second NCore site, with NCore parameters coming online January 1, 2011. However, DES has monitored several parameters at this site for a number of years. 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 2288 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, DES considers this station to be of high scientific value for transport measurements on a regional scale.

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 station. While the power plant is currently completing pollution control upgrades for SO_2, this station is critical for tracking progress and for its measurements of exposure 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 Pierce Island on the Piscataqua River just to the east of downtown Portsmouth. DES 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 sea breeze-generated ozone events. Past experience monitoring ozone in Rye found that sea breeze events sometimes generate the highest ozone in the state. These events target 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 periodic high ozone events.

Woodstock

The Woodstock monitoring station is a Clean Air Status and Trends Network (CASTNET) site operated by EPA for trends monitoring. DES supports this site and uses the data for regional ozone tracking.

Beta Attenuation Federal Equivalency Method (FEM) Monitoring

DES has implemented FEM continuous (hourly) $PM_{2.5}$ sampling at several stations with Met One Inc. Beta Attenuation Monitors (BAM) - FEM EQPM-0308-170. To date, DES operates BAMs at the Keene, Lebanon, Londonderry, Pack Monadnock, and Portsmouth stations. Please note that whenever BAMs are collocated and operated in conjunction with Federal Reference Monitors (FRM) samplers, DES will report BAM data as “primary”. Any FRM data generated at these sites will be considered secondary when BAM data are available.

Network Modifications

DES made several modifications to the air monitoring network between July 1, 2011 and June 30, 2012. Modifications consisted of new site and monitor installations, infrastructure development, and discontinuation of select monitors. Specific network modifications include;

Keene, Water Street
- **Alter $PM_{2.5}$ Filter Based Sampling Frequency** – DES changed the $PM_{2.5}$ FRM sampling frequency from once every six days to once every 12 days starting on January 1, 2012. DES placed a BAM at this station during January 2010. The BAM is considered a Federal Equivalent Method for $PM_{2.5}$ and produces real-time (hourly) data. The BAM will be considered DES’ primary monitor at this station.

Londonderry, Moose Hill School
- **Lead Monitoring -** DES initiated lead monitoring in concert with regulatory requirements at this station starting January 1, 2012.

Manchester, Pearl Street
- **Discontinue $PM_{2.5}$ TEOM Monitoring –** DES discontinued $PM_{2.5}$ continuous monitoring with the 8500AB TEOM at this location in August 2011. This TEOM was not an EPA approved method for $PM_{2.5}$ sampling. This discontinuation makes sense in light of DES’ limited resources and the fact that, upon discontinuation of CO and SO_2 monitoring at this station, Manchester, Pearl Street would be left with only a single parameter monitored by a non-EPA approved sampler.

- **Discontinued Station (shutdown) –** DES shut this station down after the 1st quarter of 2012. DES and EPA had agreed to shutdown this station down in accordance with the previous Annual Network Plan; however DES was keeping it operational until an alternative CO triggering mechanism could be approved by EPA (see below). Recent activity surrounding the station presented security related concerns and prompted DES to shut down the station for safety reasons.

Relative to CO State Implementation Plan requirements, DES drafted a revision to modify both the Nashua and Manchester Maintenance Plans to establish an alternative triggering mechanism which relies on CO data from the Londonderry NCore monitoring station and NH Emissions Inventories. On July 23, 2012, the public comment period for the “Carbon Monoxide Limited Maintenance Plan for the City of Manchester and the City of Nashua Carbon Monoxide Maintenance Areas” closed and having received no public comment, the Department formally submitted the Plan to EPA where it is presently under review.

Peterborough, Pack Monadnock Mountain – Summit
– Constructed a New Station for NCore – Due to space limitations in the old air monitoring structure, DES modified the Old State Police Building at the base of the fire tower on Pack Monadnock Mountain to meet NCore monitoring needs. DES started the construction phase for this project during October 2010 and was operational in the new station in November 2011.

Future Plans

In Support of continuous efforts to improve performance and maximize network efficiency under a constrained budget, DES plans to implement several changes during the upcoming year – July 2012 through June 2013:

NO_2 Monitoring – As the federal NO_2 road-side monitoring implementation moves forward, it is uncertain if New Hampshire will be required to perform additional monitoring. The initial step of a 2-step process includes establishing a single road-side monitor near a high-traffic intersection near the center of the Boston CMSA. Should the levels of NO_2 measured at this location be near or above the NAAQS, then additional monitoring may be needed within the Boston CMSA. During this phased process, DES will coordinate with Massachusetts DEP and EPA Region to track initial road-side NO_2 data and the need to expand monitoring, consistent with final January, 2010 NO_2 NAAQS and relevant EPA guidance.

SO_2 Monitoring – DES intends to modify the current SO_2 monitoring network, if necessary, to fulfill recently promulgated regulatory requirements (SO_2 NAAQS Rule – June 2, 2010). According to this rule, there are two monitors required in the multistate area of Boston, MA – NH, and one in Concord, NH. DES will work with EPA to determine the most appropriate way to meet the intent of these new SO_2 monitoring regulations. The current network infrastructure may be adequate. Nonetheless, DES intends to have any new SO_2 required monitoring, under this rule, operational as required by EPA.

Purchasing/Expenses

DES' budget cycle runs from July 1 through June 30 each year. DES did not have any funding for significant equipment procurement during this budget cycle. DES did, however, expend considerable resources upgrading the air monitoring site on Pack Monadnock Mountain. DES used air monitoring funds for personnel, consumables, parts and supplies to operate the air monitoring network. Additionally, DES 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 EPA and safety standards.

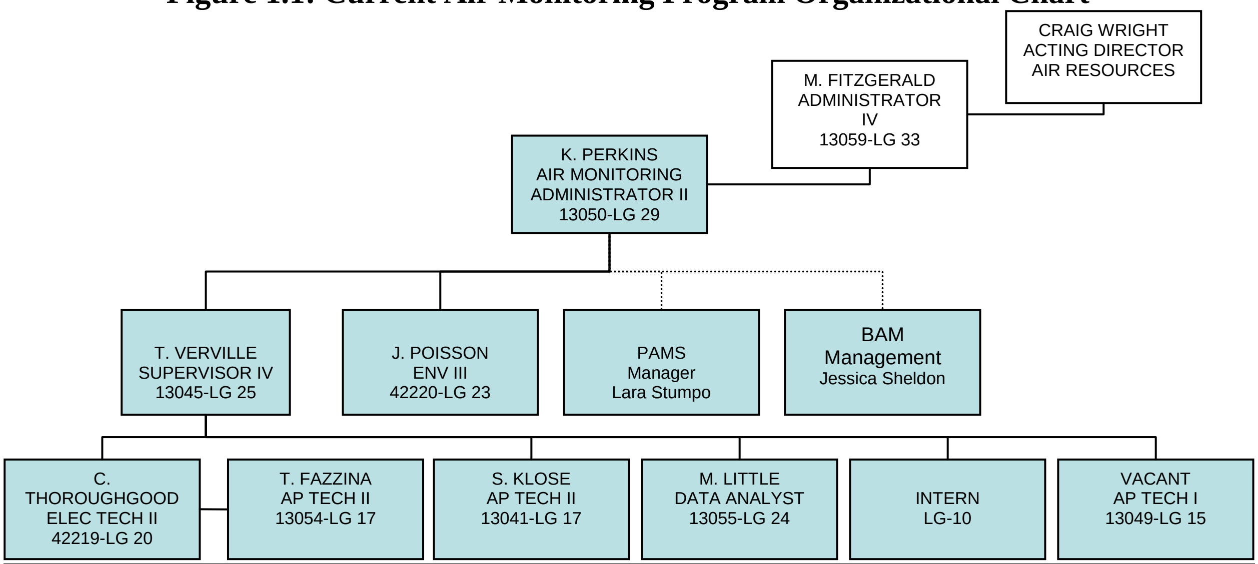
Please note that a number of analyzers and samplers in DES' network are old and require frequent maintenance in order to provide adequate data. In fact, most of DES' filter based particle samplers are in need of replacement. Table 1.0 presents equipment, analyzers, and samplers that DES currently uses 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)
NO_y
Ecotech Model 9843 NOy
Particulate Matter
R&P Partisol Model 2000 (filter based)
R&P Partisol Model 2025 (filter based)
BGI Model PQ200 (filter based)
R&P TEOM Model 1400
Met One BAM Model 1020
Calibrator (multiple parameter)
Monitor Labs Model 8500
TECO 165 Multi Gas Calibrator
Teledyne – API Model 700, 700E and 700U Gas Calibrators
Environics Series 6103 Multi Gas Calibrator
Data Acquisition System
Environmental Systems Corporation (ESC) Data Logger Model 8816
ESC Data Logger Model 8832
Agilaire Software and support Agreement
PAMS
Perkin Elmer Ozone Precursor System- Clarus 500 Gas Chromatograph, TurboMatrix 100 Thermal Desorber
Perkin Elmer Total Chrom Software- version 6.2.1
Parker Balston TOC Gas Generator
Perkin Elmer Hydrogen Generator
Parker Balston Hydrogen Generator
Uninterrupted Power Supply- APC Model SURT8000XLT

Personnel

The AMP continues to operate with one full-time technical position vacant as wellas one technical position previously eliminated. Due to current budget constraints, DES has no immediate intent to fill the vacant position. DES assigns some technical support duties to individuals outside the official AMP organizational structure, including continuous $PM_{2.5}$ management and PAMS management duties, as illustrated in Figure 1.1.

Figure 1.1: Current Air Monitoring Program Organizational Chart



Cooperative Air Monitoring Initiatives

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

For over 22 years now, the Appalachian Mountain Club (AMC) and DES have been joining resources to conduct ozone monitoring in Coos County. Since 1990, AMC and DES 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 DES 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 DES significant resources.

DES also partners with the United States 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. DES and AMC currently maintain ozone sampling, upkeep, and routine site inspections at this station.

DES provides critical real-time rainfall data to the New Hampshire Department of Corrections for the protection of public health. When rainfall at the Laconia, Green Street station exceeds a specific amount over a specific time period, an automated notification system operated by DES 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.

Quality Assurance Project Plans (QAPPs)

The AMP currently operates in accordance with two QAPPs, one for particle sampling and one for gaseous sampling. The AMP has not made any significant changes to the overall quality assurance program in the past year. DES does intend to complete, and submit, minor QAPP updates to EPA by October 1, 2012.

Monitoring Trends

Each year, DES reviews its monitoring data and calculates design values for comparison to the National Ambient Air Quality Standards (NAAQS) – Table 1.1. EPA 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 4^{th} highest annual ozone value of an 8-hour duration.

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 lowered to be more protective, thus we have more progress to make.

Figures 1.2 through 1.13 present monitoring trends for the key criteria pollutants for the period 1997 through 2011. In all cases, air quality is significantly improved from the 1970s and 1980s. Currently monitored levels of nitrogen dioxide (NO_2) and carbon monoxide (CO) are safely below the current levels of the NAAQS. However, the NAAQS for ozone and $PM_{2.5}$ have recently been tightened (lowered) to levels near what is currently being measured in New Hampshire. It is these two pollutants that have drawn significant attention by DES as a focus for monitoring and SIP planning. In addition, the NAAQS for lead was strengthened. New Hampshire does not currently monitor for lead, but historical monitoring in the state suggest that lead concentrations are well below this new NAAQS. Current monitoring for NO_2 indicates that New Hampshire meets the level of the recently altered 1-hour NAAQS, although the New Hampshire network does not yet include a road-side NO_2 monitor.

An SO_2 1-hour NAAQS was recently added with a threshold of 0.075 parts per million (ppm). While New Hampshire's sulfur dioxide levels meet the 3-hour NAAQS, the attainment status for the new SO_2 NAAQS is questionable in many parts of the state at the moment. Current monitoring indicates Manchester and Portsmouth are below the new NAAQS, but Pembroke is above the 0.075 ppm threshold. However, much of the elevated levels of SO_2 in central New Hampshire is caused by a coal-burning power plant that is currently installing a SO_2 scrubber which will be operational and reducing SO_2 emissions by at least 90% in the next 2-3 years.

Tables 1.2 through 1.6 provide the five-year maximum and most recent (2011) design values for each criteria pollutant. These are also expressed as percentages of the current NAAQS. CO and NO_2 design values are all under 50% of the NAAQS. The 3-hour SO_2 design value stays under 60% of the NAAQS. However, the highest SO_2 site, Pembroke, exceeded the NAAQS in 2011. With the lower ozone standard of 0.075 ppm, Pack Monadnock summit just barely exceeded the standard in 2010, but it and all other sites are under the standard in 2011.

New Hampshire operates two Photochemical Assessment Monitoring Stations (PAMS): Pack Monadnock and Nashua. Tables 1.11 and 1.12 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 ug/m^3. At Pack Monadnock and Nashua, the maximum 24-hour averages for benzene over the full period were about 1.1 ug/m^3, which is about 12% of the AAL. Maximum values for all the other parameters for both sites are consistently less than 1% of their AAL.

Table 1.1: National Ambient Air Quality Standards

	Primary Standards		Secondary Standards	
Pollutant	**Level**	**Averaging Time**	**Level**	**Averaging Time**
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour (1)	None	
	35 ppm (40 mg/m^3)	1-hour (1)		
Lead	0.15 µg/m^3 (2)	Rolling 3-Month Average	Same as Primary	
Nitrogen Dioxide	53 ppb (3)	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour (4)	None	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour (5)	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual (6) (Arithmetic Average)	Same as Primary	
	35 µg/m^3	24-hour (7)	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour (8)	Same as Primary	
	0.08 ppm (1997 std)	8-hour (9)	Same as Primary	
Sulfur Dioxide	75 ppb (10)	1-hour	0.5 ppm	3-hour (1)

(1) Not to be exceeded more than once per year.
(2) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
(3) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard
(4) To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).
(5) Not to be exceeded more than once per year on average over 3 years.
(6) To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.
(7) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).
(8) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)
(9) (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
(c) EPA is in the process of reconsidering these standards (set in March 2008).
(10) (a) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

Table 1.2: 2009 – 2011 Ozone Design Values (ppb)

Ozone	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2011 Max DV	% of NAAQS	Location
8-Hour	3-year average of 4th-highest daily maximum 8-hour averages	75	80	107%	Pack Monadnock	70	93%	Pack Monadnock

Table 1.3: 2009 – 2011 Carbon Monoxide Design Values (ppm)

CO	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2011 Max DV	% of NAAQS	Location
1-Hour	2nd maximum over 3 years	35	9.1	26%	Nashua	3.2	9%	Manchester
8-Hour	2nd maximum over 3 years	9	3.5	39%	Manchester	2.4	27%	Manchester

Table 1.4: 2009 – 2011 Sulfur Dioxide Design Values (ppb)

SO_2	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2011 Max DV	% of NAAQS	Location
1-Hour	3-year average of 99th percentile of daily maximum 1-hour averages	0.075	0.213	284%	Pembroke	0.213	284%	Pembroke
3-Hour	2nd maximum over 3 years	0.5	0.221	44%	Pembroke	0.193	39%	Pembroke

Table 1.5: 2009 – 2011 Nitrogen Dioxide Design Values

NO_2	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2011 Max DV	% of NAAQS	Location
1-Hour	3-year average of 98th percentile of daily maximum 1-hour averages	100	46	46%	Manchester	11	11%	Nashua
Annual	Annual average over 3 years	53	11	21%	Manchester	2	4%	Nashua

Table 1.6: 2009 – 2011 Fine Particulate Matter Design Values (μg/m^3)

$PM_{2.5}$	Design Value (DV) Description	NAAQS	5-Year Max DV	% of NAAQS	Location	2011 Max DV	% of NAAQS	Location
24-Hour	3-year average of 98th percentile of midnight-to-midnight 24-hour averages	35	29	83%	Keene	29	83%	Keene
Annual	Annual average over 3 years	15	11	73%	Keene	10	67%	Keene

Figure 1.2: Ozone trends for the 8-hour NAAQS (1997-2011)

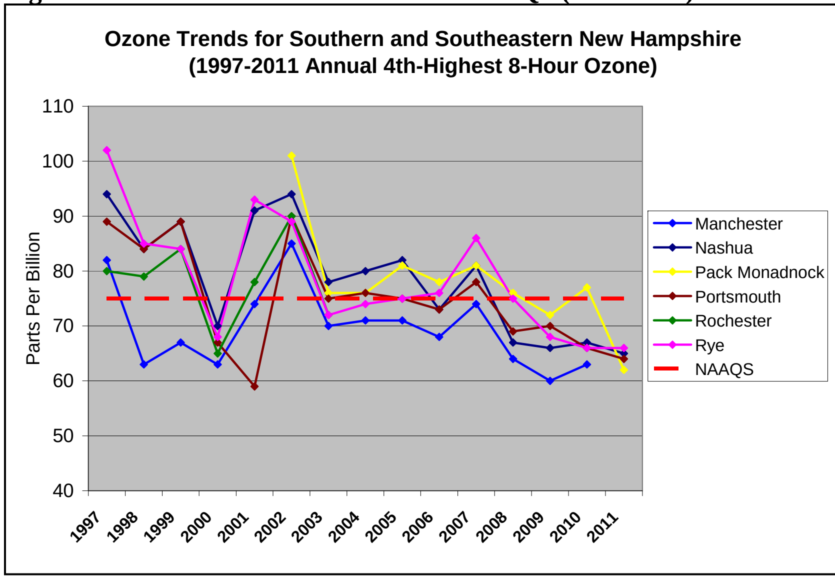


Figure 1.3: Ozone trends for the 8-hour NAAQS (1997-2011)

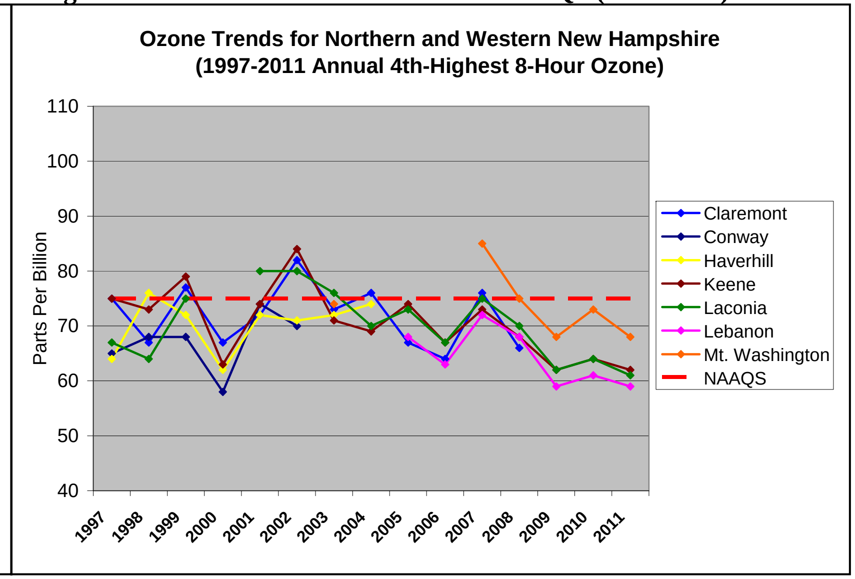


Figure 1.4: Carbon Monoxide trends for the 1-hour NAAQS (1997-2011)

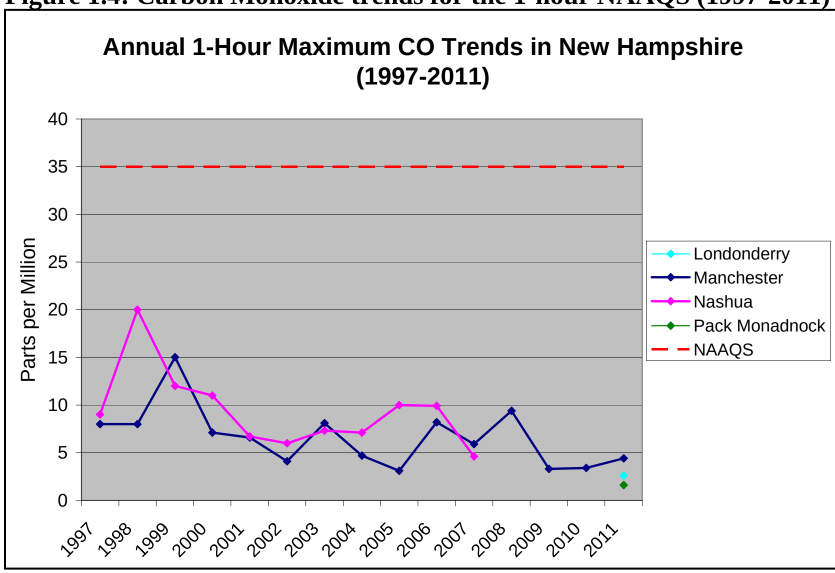


Figure 1.5: Carbon Monoxide trends for the 8-hour NAAQS (1997-2011)

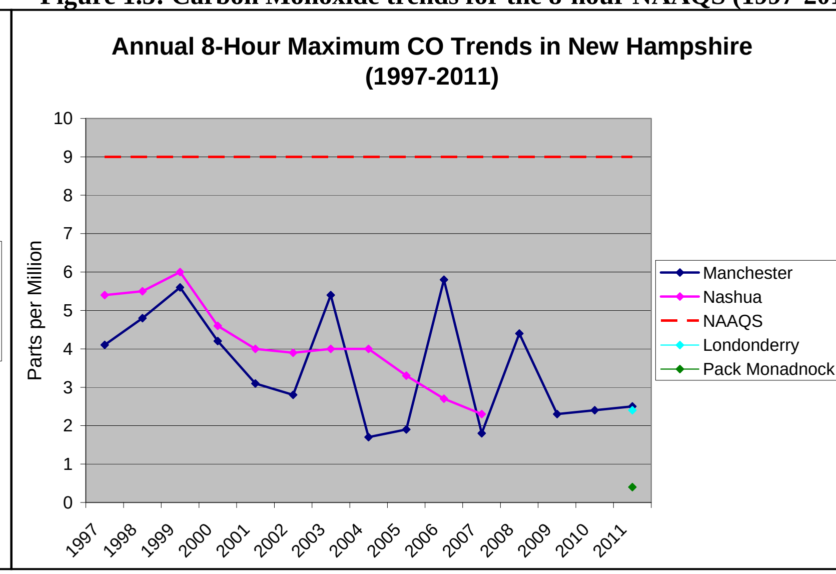


Figure 1.6: $PM_{2.5}$ trends for the 24-hour NAAQS (2001-2011)

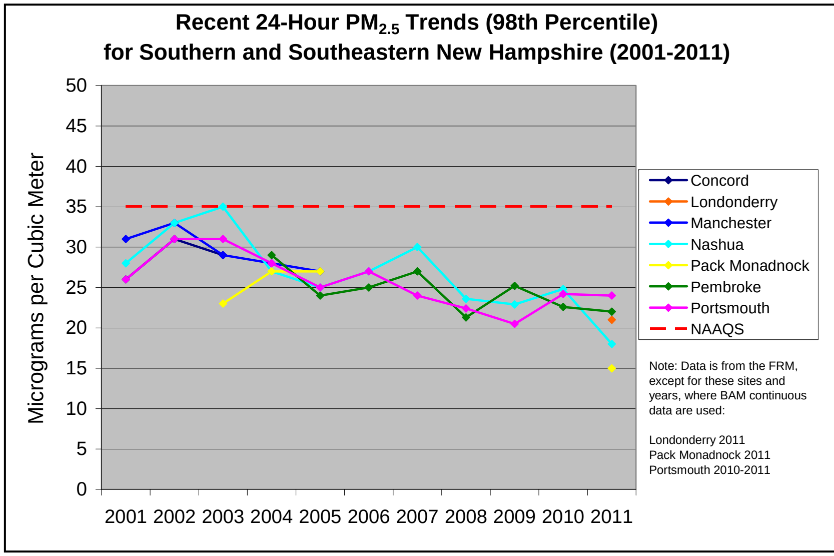


Figure 1.7: $PM_{2.5}$ trends for the 24-hour NAAQS (2001-2011)

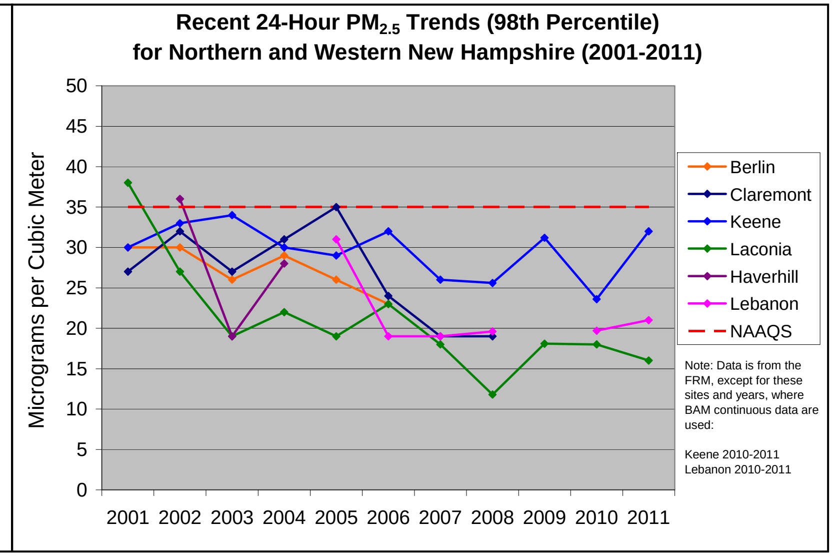


Figure 1.8: $PM_{2.5}$ trends for the annual NAAQS (2001-2011)

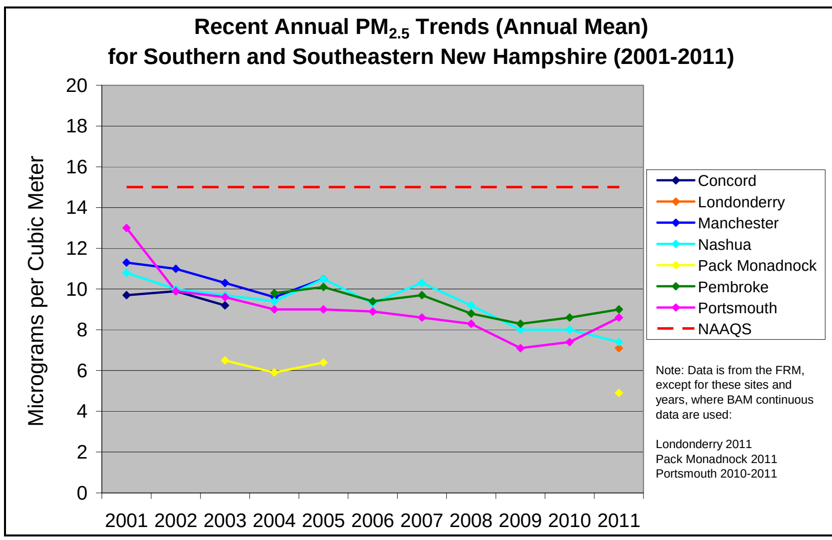


Figure 1.9: $PM_{2.5}$ trends for the annual NAAQS (2001-2011)

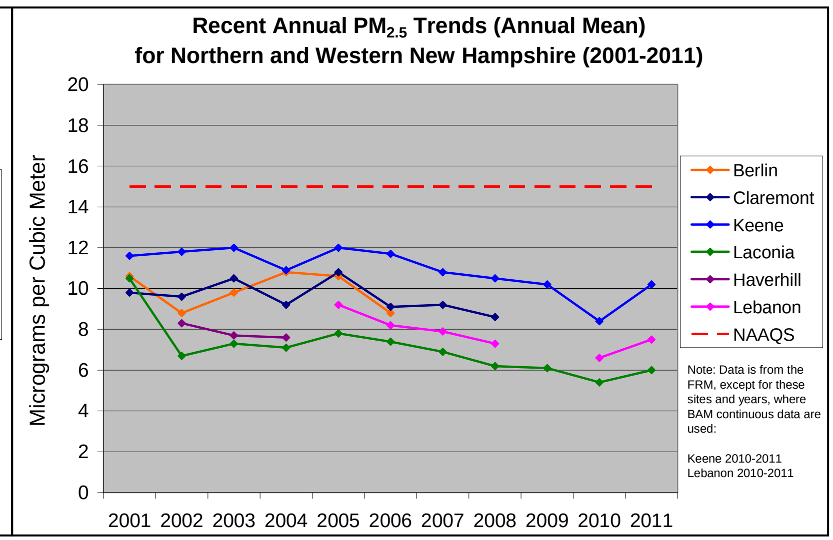


Figure 1.10: Nitrogen Dioxide trends for the 1-hour NAAQS (2001-2011)

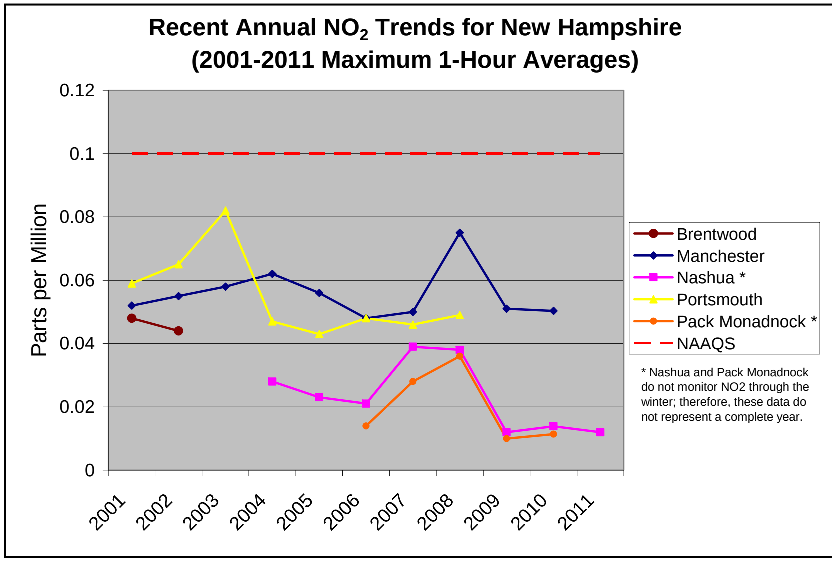


Figure 1.11: Nitrogen Dioxide trends for the annual NAAQS (2001-2011)

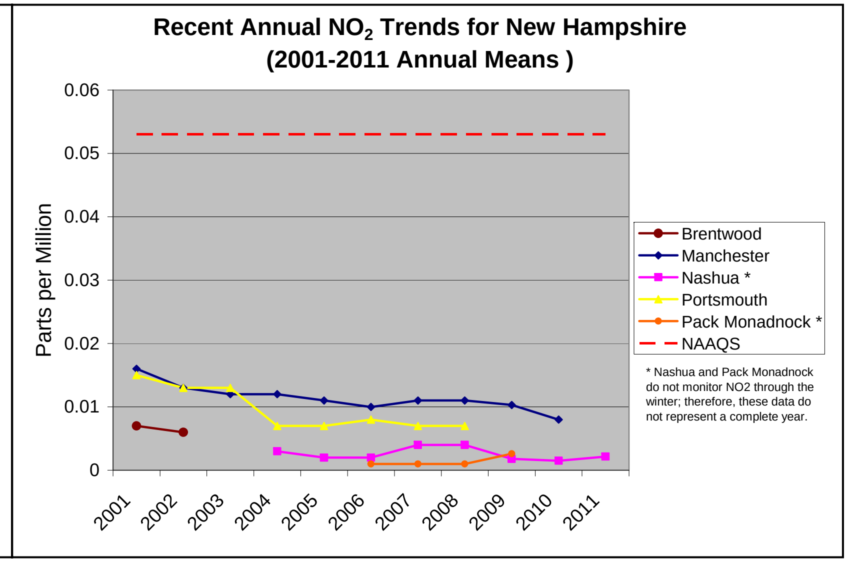


Figure 1.12: Sulfur Dioxide trends for the 1-hour NAAQS (2001-2011)

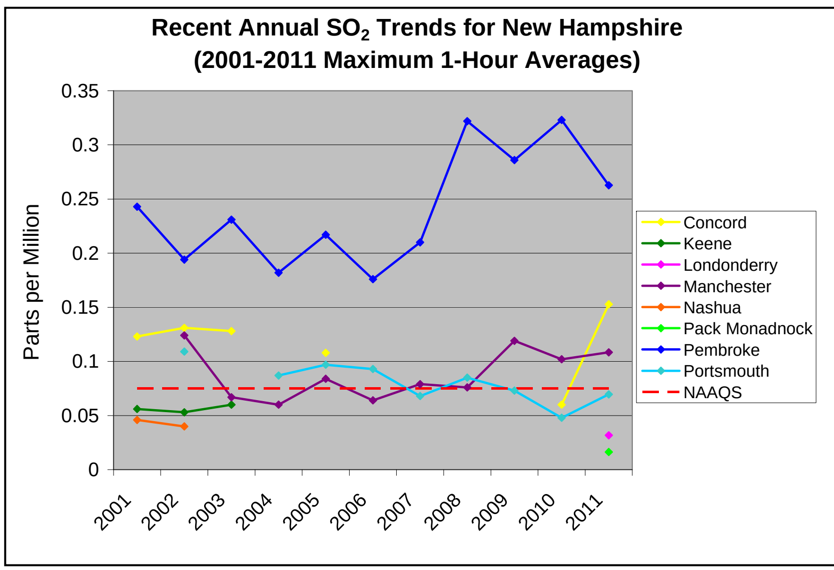


Figure 1.13: Sulfur Dioxide trends for the 3-hour NAAQS (2001-2011)

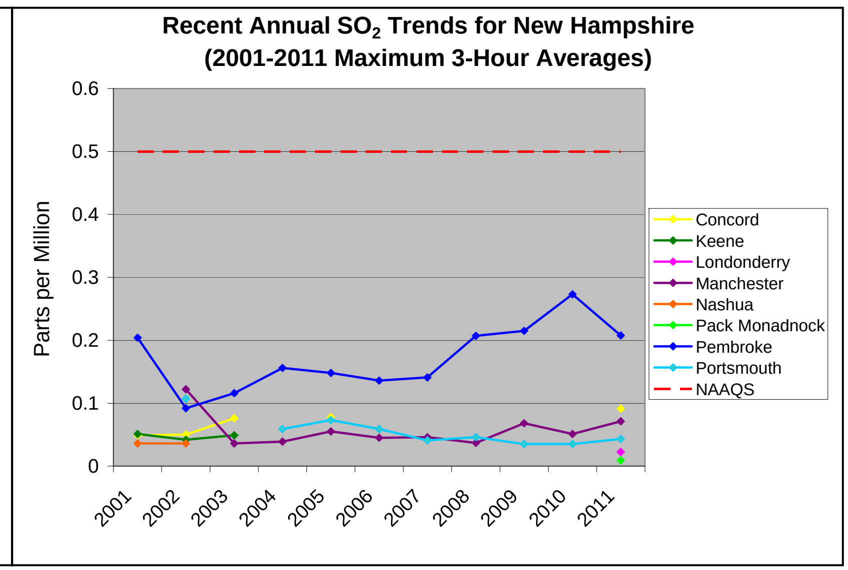


Table 1.7: New Hampshire State and Local Air Monitoring Stations Network – 2011/2012					
SO_2					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Londonderry	Moose Hill School	33 015 0018	Continuous	Regional	Population
Manchester	Pearl Street	33 011 0020	Continuous	Urban	Population
Pembroke	Pembroke Highway Dept.	33 013 1006	Continuous	Neighborhood	High Concentration
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research
Portsmouth	Pierce Island	33 015 0014	Continuous	Neighborhood	Population
Concord	Hazen Drive	33 013 1007	Continuous	Neighborhood	Population
CO					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Londonderry	Moose Hill School	33 015 0018	Continuous	Regional	Population
Manchester	Pearl Street	33 011 0020	Continuous	Middle	High Concentration
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	Neighborhood	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	Pierce 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	Moose Hill School	33 015 0018	Continuous	Regional	Population
Nashua	Gilson Road	33 011 1011	June - Sept	Neighborhood	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research

Table 1.8: New Hampshire Particulate Matter Network – 2011/2012					
$PM_{2.5}$					
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
Lebanon	Lebanon Airport	33 009 0010	1 in 12 filter	Neighborhood	Population
Lebanon	Lebanon Airport	33 009 0010	Continuous - BAM	Neighborhood	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
Nashua	Crown Street	33 011 1015	1 in 6 filter	Urban	High Concentration
Pembroke	Pembroke Highway Dept.	33 013 1006	1 in 3 filter	Neighborhood	High Concentration
Pembroke	Pembroke Highway Dept.	33 013 1006	1 in 6 filter	Neighborhood	Collocate Audit
Peterborough	Pack Monadnock	33 011 5001	Continuous - BAM	Regional	Research
Peterborough	Pack Monadnock	33 011 5001	1 in 3 filter	Regional	Research
Portsmouth	Pierce Island	33 015 0014	1 in 12 filter	Regional	Population
Portsmouth	Pierce 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
PM10					
Londonderry	Moose Hill School	33 015 0018	1 in 3 filter	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	1 in 3 filter	Regional	Research
Portsmouth	Pierce Island	33 015 0014	1 in 6 filter	Neighborhood	Population
Portsmouth	Pierce Island	33 015 0014	1 in 6 filter	Neighborhood	Audit

Table 1.9: New Hampshire PAMS Network – 2011/2012					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Nashua	Gilson Road	33 011 1011	June - Sept	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	June - Sept	Regional	Research

Table 1.10: New Hampshire NCore Network – 2011/2012					
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 1.11: Seasonal Maximum 24-hour Averages at Gilson Road in Nashua for Toxic PAMS Species Compared to the Ambient Allowable Limit (AAL), 2005-2011

PAMS Parameter	AAL ug/m^3	Max 24-hour Avg. (ug/m^3)							Max as % of AAL
		2005	2006	2007	2008	2009	2010	2011	
PROPYLENE (43205)	35,833	0.55	0.34	0.30	0.33	0.35	0.20	1.29	0.00%
CYCLOPENTANE (43242)	25,595	0.23	0.23	0.16	0.13	0.15	0.10	0.30	0.00%
ISOPENTANE (43221)	36,875	2.04	2.50	1.56	1.41	1.23	1.13	4.58	0.01%
PENTANE (43220)	36,875	3.13	1.39	0.85	0.74	0.76	0.61	1.99	0.01%
2-METHYLPENTANE (43285)	36,875	0.60	0.78	0.21	0.35	0.25	0.18	0.45	0.00%
3-METHYLPENTANE (43230)	36,875	0.41	0.48	0.20	0.30	0.20	0.25	0.44	0.00%
HEXANE (43231)	885	0.59	0.58	0.47	0.74	0.51	1.18	1.17	0.13%
BENZENE (45201)	5.7	0.51	0.74	0.36	0.42	0.37	0.29	1.11	19.46%
CYCLOHEXANE (43248)	6,000	0.25	0.21	0.21	0.48	0.19	0.29	0.41	0.01%
HEPTANE (43232)	8,249	0.56	0.34	0.18	0.32	0.25	0.12	0.43	0.01%
METHYLCYCLOHEXANE (43261)	23,958	0.21	0.21	0.11	0.16	0.10	0.06	0.30	0.00%
TOLUENE (45202)	5,000	2.37	2.67	1.39	1.97	1.60	1.77	2.18	0.05%
OCTANE (43233)	7,000	0.32	0.13	0.10	0.13	0.09	0.07	0.25	0.00%
ETHYLBENZENE (45203)	1,000	0.36	0.36	0.18	0.39	0.57	0.14	0.47	0.06%
M & P-XYLENES (45109)	1,550	0.88	0.96	0.68	1.15	2.04	0.45	1.22	0.13%
STYRENE (45220)	1,000	0.88	0.13	0.22	0.07	0.06	0.13	0.19	0.09%
O-XYLENE (45204)	1,550	0.32	0.36	0.26	0.40	0.40	0.16	0.56	0.04%
NONANE (43235)	15,625	0.21	0.13	0.21	0.10	0.11	0.07	0.33	0.00%
1,3,5-TRIMETHYLBENZENE (45207)	619	0.11	0.12	0.09	0.32	0.17	0.09	0.44	0.07%
1,2,4-TRIMETHYLBENZENE (45208)	619	0.32	0.39	0.32	0.39	0.31	0.18	0.47	0.08%

Table 1.12: Seasonal Maximum 24-hour Averages at Pack Monadnock in Miller State Park for Toxic PAMS Species Compared to the Ambient Allowable Limit (AAL), 2006-2011

PAMS Parameter	AAL (ug/m^3)	Max 24-hour Avg. (ug/m^3)						Max as % of AAL
		2006	2007	2008	2009	2010	2011	
PROPYLENE (43205)	35,833	0.28	0.25	0.46	0.15	0.20	0.59	0.00%
CYCLOPENTANE (43242)	25,595	0.42	0.53	1.63	0.09	0.29	0.29	0.01%
ISOPENTANE (43221)	36,875	1.03	1.09	0.70	0.89	0.75	1.84	0.00%
PENTANE (43220)	36,875	45.41	7.63	0.55	0.45	0.38	0.86	0.12%
2-METHYLPENTANE (43285)	36,875	0.19	0.27	0.04	0.06	0.04	0.30	0.00%
3-METHYLPENTANE (43230)	36,875	0.13	0.17	0.01	0.04	0.03	0.21	0.00%
HEXANE (43231)	885	0.21	0.27	0.19	0.32	1.36	1.01	0.15%
BENZENE (45201)	5.7	0.31	0.33	0.32	0.41	0.73	1.09	19.18%
CYCLOHEXANE (43248)	6,000	0.14	0.05	0.02	0.08	0.04	0.48	0.01%
HEPTANE (43232)	8,249	0.71	0.16	0.15	0.17	0.13	0.79	0.01%
METHYLCYCLOHEXANE (43261)	23,958	1.23	0.15	0.15	0.11	0.16	0.49	0.01%
TOLUENE (45202)	5,000	1.00	1.05	1.11	1.01	0.77	2.48	0.05%
OCTANE (43233)	7,000	0.91	0.17	0.27	0.11	0.06	0.40	0.01%
ETHYLBENZENE (45203)	1,000	0.35	0.20	0.59	0.21	0.15	0.42	0.06%
M & P-XYLENES (45109)	1,550	1.88	0.37	2.38	0.46	0.23	1.22	0.15%
STYRENE (45220)	1,000	1.03	1.13	1.80	0.40	0.08	0.18	0.18%
O-XYLENE (45204)	1,550	0.60	0.13	0.67	0.15	0.08	0.45	0.04%
NONANE (43235)	15,625	8.83	1.33	0.57	0.23	0.08	0.16	0.06%
1,3,5-TRIMETHYLBENZENE (45207)	619	1.75	0.08	0.29	0.13	0.04	0.10	0.28%
1,2,4-TRIMETHYLBENZENE (45208)	619	3.91	1.34	0.79	0.53	0.14	0.38	0.63%