NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Air Resources Division – Technical Services Bureau
Ambient Air Monitoring Program
2010/2011 Annual Network Review and Plan

and

5 Year Network Assessment

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Acknowledgements

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Introduction

The New Hampshire Department of Environmental Services (DES) respectfully submits this 2010/2011 Ambient Air Monitoring Program Annual Network Review Plan - and - 5 Year Network Assessment 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 helping us improve and maintain New Hampshire's Air Monitoring Network.

Part 1 of this document reviews structure, objectives, recent history and data trends associated with DES' Air Monitoring Program (AMP). Part 2 is DES' Five Year Air Monitoring Network Assessment and Part 3 details individual air monitoring station information.

Part 1: 2010/2011 Annual Network Review and Plan

In our efforts to improve performance and maximize network efficiency under a constrained budget, DES has affected a number of changes over this report period. Our key objectives remain to provide quality ambient air data to determine attainment status with NAAQS - National Air Quality Standards (Table 1.0) - guide future policy decisions at the state, national, and international levels – and protect public health through real-time mapping and air pollution alert initiatives. DES continually revisits and stresses basic air monitoring fundamentals to allow for reliable, high-quality data capture and analysis. Tables 1.2 through 1.5 summarize the current status of the New Hampshire ambient air monitoring network. Specific station information can be found in Part 3 of this Annual Review Plan.

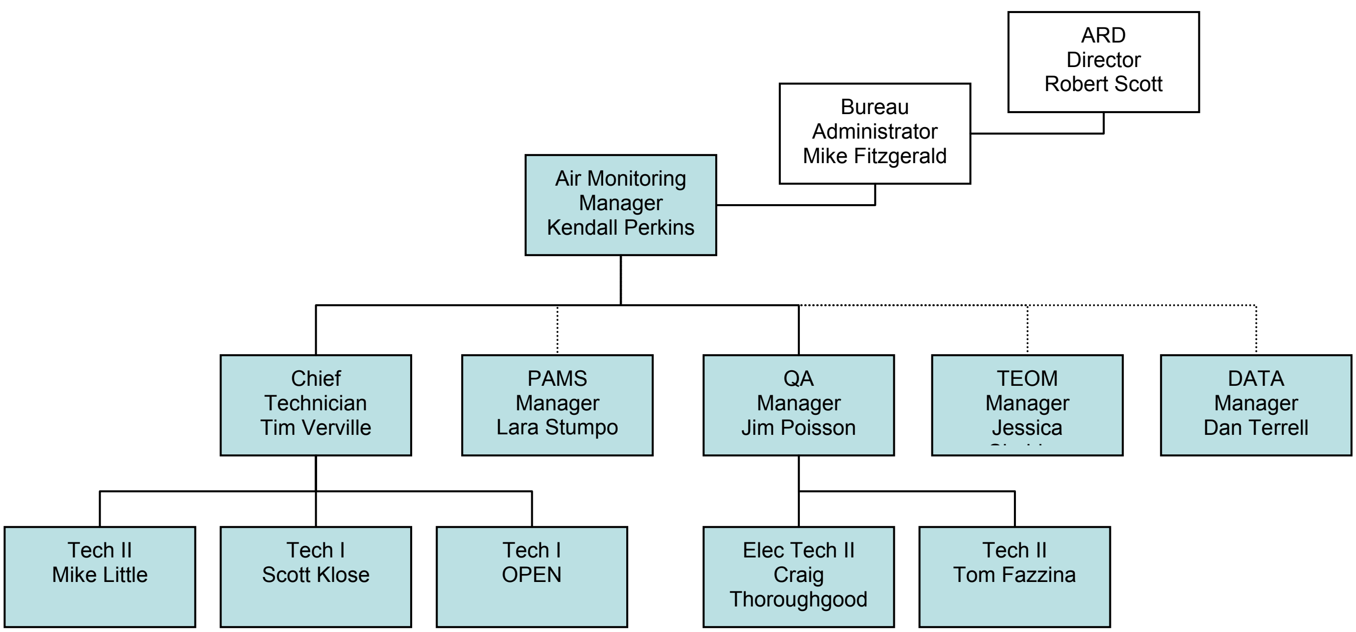


Figure 1.1: Current Air Monitoring Program Organizational Chart

Personnel

For several years, the Air Monitoring Program has been operating with one full-time technical position vacant and one technical position eliminated. AMP staff have adapted their efforts and taken on more responsibilities to meet critical work objectives. Although there are no changes to the organizational structure, at this time, DES is pursuing an official reorganization of the AMP to reflect actual organizational structure and individual work responsibilities.

DES has no immediate intent to fill the vacant position, due to current budget constraints; however, DES assigns some technical support duties to individuals outside the AMP, including data, TEOM (Tapered Element Oscillating Membrane continuous particulate matter monitor) and PAMS management duties, as illustrated in Figure 1.1.

Monitoring Objectives

In the interest of public health and the environment, DES operates a network of air monitoring sites throughout the state. These sites facilitate monitoring of ambient ozone, sulfur dioxide, nitrogen dioxide, certain air toxics, volatile and semi-volatile organic compounds, carbon monoxide and particulate matter levels.

DES' mission is "to help sustain a high quality of life for all citizens by protecting and restoring the environment and public health in New Hampshire". Air monitoring data from DES' network helps determine the status of air quality coming into New Hampshire from areas upwind, predict air pollution episodes, enact protective actions and warnings, develop emission reduction strategy, assess effectiveness of emission reduction strategies, supports health assessments and supports NAAQS reviews.

The current New Hampshire ambient air monitoring network is carefully configured to provide health protection 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 either the community is not at risk or can be adequately represented by a nearby monitor. Topography, geographic coverage, and air pollution modeling were also considered in the current network design.

In recent years, the number of individual monitoring stations has been reduced in order to meet demands for ever increasing network efficiency. 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 trends. In 2010, the network will actually grow by one station with the addition of a new super station in suburban Londonderry as part of the NCORE monitoring program. This station was carefully selected as being central to the typical New Hampshire population in a portion of the state that is heavily populated, growing, and historical monitoring has demonstrated periodic events of unhealthy air quality.

Ambient air pollution monitoring began in new Hampshire in the 1970s with just a few locations and grew to were each of the state's ten counties hosted monitoring stations for air pollutants known to be released in the area. Over time, pollution controls were installed and facilities shut down, allowing the air quality in those counties to improve well into the good zone. For example, paper mills in Coos County used to emit fairly high levels of sulfur dioxide and particles into the air 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, and thus monitoring resources have been reallocated. DES continues to track emission inventories and reports of health concerns in these areas in order to assess if air monitoring should return to the area.

Now, in 2010, 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 thousand 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 and volatile organic compounds), small particles ($PM_{2.5}$), and sulfur dioxide. 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, thus the monitoring network for these pollutants extend 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 NH.

Population Distribution and Sensitive Populations

40 CFR 58.10(d) specifies that 5-year assessments include an evaluation of current or proposed changes in air monitoring locations based on population distribution, with particular emphasis on "sensitive populations" such children and adults with asthma, and children in poverty. This section summarizes NH data in these areas.

According to 2006-2008 survey data reported in the NH Asthma Burden Report (Traore, 2010), 10.2% of adults and 9.0% of children in NH had asthma during this period. County asthma prevalence rates varied widely (Figure 1.11), although none were significantly different than the statewide average. The rank order of counties in child asthma prevalence revealed no clear trend in rural/urban differences.

Figure 1.12 depicts Emergency Department visit rates for asthma attacks among NH children by county in 2003-2004 (NH Department of Health & Human Services, 2007). Five of the sixth most rural counties in NH were ranked highest among the 12 major geographic areas of the state, and each were significantly higher than the overall State rate. The City of Nashua, ranked 6th, is the only other rate that was significantly higher than the state rate. The other five counties (four of the five among the least rural) were within or below the confidence limits of the state average.

The asthma survey cited above (Traore, 2010) documented that asthma prevalence in NH during 2006-2008 was 1.7 times higher among children and adults in households with less than $25,000 income than it was for those with family income of $25,000 or greater. This underscores the importance of using socioeconomic data to track those at highest risk of asthma. Figure 1.13 presents the rate (and number) of children in poverty for NH counties and its two largest cities, Manchester and Nashua (US Census Bureau, 2010). Manchester exhibited by far the highest percent and number of children in poverty. Child poverty rates are fairly mixed among rural and urban counties, though not surprisingly, the highest numbers of children in poverty are from the most urban (and populous) areas: Manchester city, Merrimack, Strafford, Rockingham, Hillsborough towns, and Nashua city.

Asthma is a widespread public health problem in NH and is not isolated to individual cities or towns. DES stands ready with an extensive air pollution monitoring network to assist and coalesce with abatement efforts.

REFERENCES for Population Distribution and Sensitive Populations:

NH Department of Health & Human Services (2007) "Asthma in New Hampshire: How does asthma affect communities in New Hampshire?" Data Brief Vol.1 No.1. Division of Public Health Services Asthma Control Program • www.dhhs.state.nh.us October 2007.

Traore EA. (2010) "Chapter 1: "Asthma Prevalence and Incidence". Asthma Burden Report – New Hampshire 2010. Asthma Control Program. Division of Public Health Services, New Hampshire Department of Health and Human Services. February, 2010.

U.S. Census Bureau (2010) 2006-2008 American Community Survey
http://factfinder.census.gov/servlet/DTGeoSearchByListServlet?ds_name=ACS_2008_3YR_G00_&_lang=en&_ts=296744711649

Figure 1.2: Asthma Prevalence of NH Children Age <18 by County: NH BRFSS Respondents, 2006-2008

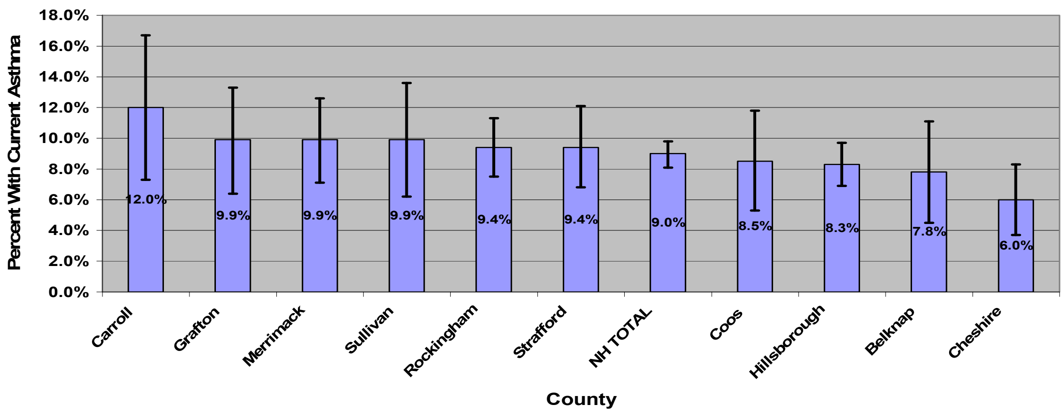


Figure 1.3: Asthma Emergency Department Visit Rates for Children <18 Years of Age: NH Residents, 2003-2004

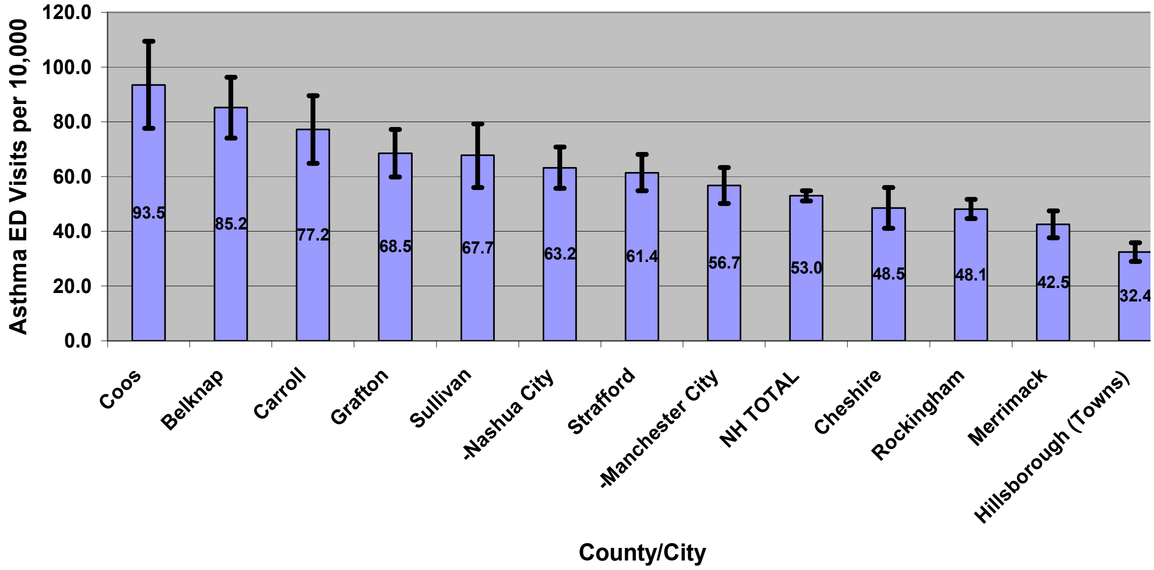
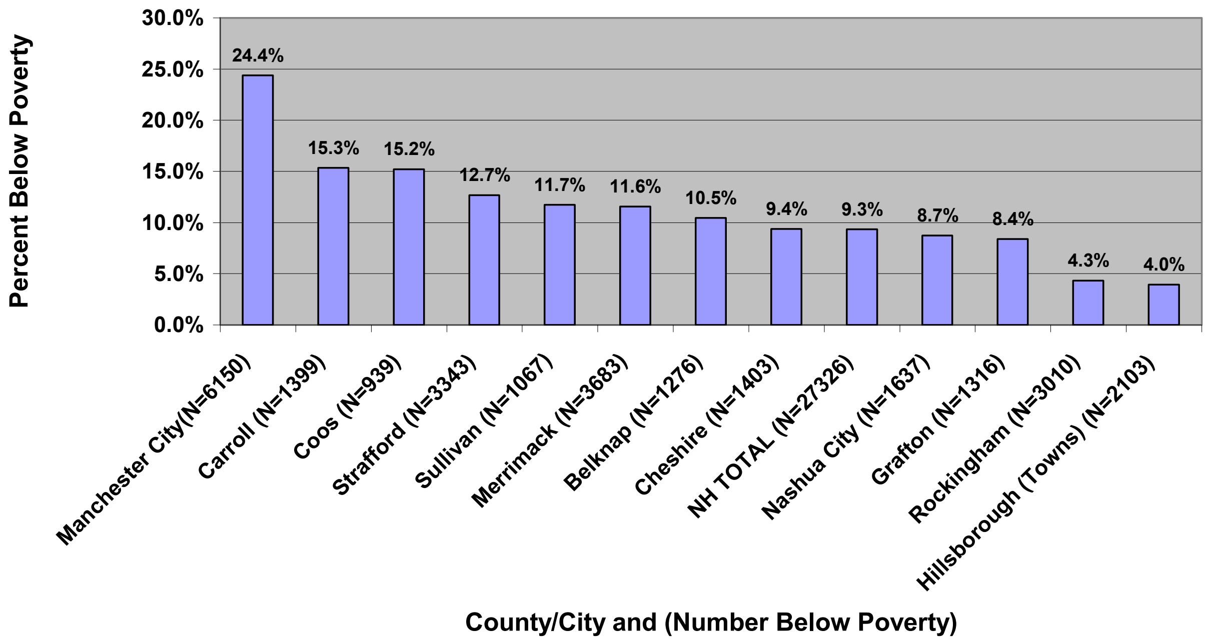


Figure 1.4: Percent of Children <18 Years old Below Poverty: NH Counties and Urban Centers, 2006-2008



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 provided alphabetically by community.

Concord

The Concord monitoring site exists primarily to track ozone, the only criteria pollutant 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 it was felt by DES that the nitrogen oxides emitted by the high volume of interstate traffic at freeway speeds would create a bubble of NOx scavenging, lowering the measured ozone levels in the immediate area. The current Hazen drive location has significantly less NOx emissions and is close to residential neighborhoods, retirement communities, and schools. This station represents population exposure on a neighborhood scale.

Greens Grant – Mt. Washington base

The Greens Grant, Camp Dodge monitor at the base of Mt. Washington is now the primary monitor representing the northern portion of NH. The monitoring location is also important since it represents two federally recognized Class I airsheds which also requires visibility monitoring (IMPROVE). Previous monitoring in the north country (Pittsburg and Conway) have been consolidated at Camp Dodge due to the high correlation between sites, low population densities, and low risk of exposure to unhealthy air quality. Currently, the highest risk for unhealthy air event in the north country is for ozone, which is monitored at Camp Dodge. 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 where ozone levels could reach unhealthy levels, justifying ozone monitoring. Similarly, $PM_{2.5}$ levels have also been of concern several days per year, but the geographic region affected is limited to within the City of Keene limits and within a few other nearby communities. The station was recently upgraded with continuous $PM_{2.5}$ monitoring equipment to better track the risks of winter-time woodsmoke build up. The new 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. This station represents population exposure. 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.

Laconia

The Laconia monitor tracks ozone for the regional "Lakes area" of the state, whose population swells during the summer months with tourists. The monitor represents the very northern edge of the Boston CBA (combined metropolitan area) and periodically experiences elevated ozone levels. This station represents population exposure on a regional scale.

Lebanon

The Lebanon monitoring station is a relatively new station designed to provide population and regional based monitoring for the Lebanon/White River Junction (VT) metropolitan area with information on regional ozone and $PM_{2.5}$. The site is also important since it represents the consolidation of the Claremont (ozone) and Haverhill (ozone and $PM_{2.5}$) monitoring stations.

The station is located on the ridge at 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 will come online in late 2010 as an NCORE super station measuring a wide selection of pollutants. The location was carefully selected 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. Once online, the site is expected to track a number of unhealthy ozone events each year. Being a multi-parameter station located in an area representative for a large population living in the northern suburbs of Boston, 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

The Manchester station is currently located in a parking lot in the downtown portion of the city. It tracks a number of pollutants including ozone, $PM_{2.5}$, SO_2, and CO. The location is important for tracking CO for maintenance purposes (previous nonattainment) and for its urban $PM_{2.5}$ tracking (note: EPA is currently reviewing the CO standard and is under a court ordered deadline to propose a standard by October 28, 2010, and issue a final standard by May 13, 2011).

As the Londonderry station comes online, a number of the monitoring units will be relocated there from Manchester, but CO and $PM_{2.5}$ monitoring will continue to be measured in Manchester because of their urban nature. While ozone in the city occasionally exceeds the NAAQS, the urban location is NOx rich and scavenges (reduces) measured ozone levels within the downtown area. The location often measures lower ozone levels than seen at nearby Nashua and Concord. The new nearby NCORE station in Londonderry is expected to show higher ozone levels than seen in Manchester and will thus be more protective of Manchester since it will better represent the Manchester suburbs where there is less NOx and subsequently likely to have higher ozone. This station represents population exposure on an urban 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 6288 feet above sea level and is far away from any significant pollution sources, thus is ideal for picking up long-range pollution transport into the northern portion of the state. The data is 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 high-low perspective. Ozone levels measured at the summit are normally higher than measured at the base and occasionally reaches 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 population based $PM_{2.5}$ on a urban basis.

Nashua – Gilson Road

The Nashua Gilson road monitor represents the new Nashua location for the previous monitor located at Spit Brook 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 well into the future. The Gilson Road monitoring station also includes PAMS monitoring equipment, 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 airmasses transporting into the area. This station represents population exposure on a regional scale.

Pack Monadnock Mt – Summit

Pack Monadnock station will become the state's second NCORE site late in 2010. Its true value lies in the fact that it is also located on a 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, and IMPROVE visibility speciation measurements, ozone, and $PM_{2.5}$. The location is of high scientific value for regional and transport elevation, 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 with relatively high levels of SO_2 emissions. While the power plant is currently undergoing pollution control upgrades for SO_2, this station is critical for tracking progress and for its measurements of exposure on a nearby basis. This station represents population exposure 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. Past monitoring in the Portsmouth area has a transient record of moving from location to location due to the inability to set long-term siting agreements and because some sites have been found to have contamination concerns from nearby industrial activity. 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 seabreeze 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 primarily to track summer-time seabreeze generated ozone events. Past experience monitoring ozone in Rye found that seebreeze 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 and the UNH sponsored ozone monitor located about 13 miles offshore on the Isle of

Shoals. This station represents a specific and limited population along the New Hampshire coastline for periodic high ozone events.

Woodstock

The Woodstock monitoring station is operated by EPA for trends monitoring. DES supports this site and uses the data for regional ozone tracking.

Network Modifications

DES made several modifications to the air monitoring network between July 1, 2009 and June 30, 2010. Modifications consisted of new monitor installations, infrastructure development, and discontinuation of select monitors. Specific network modifications include the following:

Gilson Road, Nashua

- Initiated Wind Speed and Wind Direction Collocated Monitoring - DES set up a 2nd set of wind speed and wind direction probes at this station during April 2010. The original probes remain on top of the large building located west of the air monitoring station. DES set up the collocated probes on top of the station. DES plans to look at correlation data between the collocated probes and eliminate the set of probes on top of the large building in the future if the data correlations prove similar.

Keene, Water Street

– Discontinued $PM_{2.5}$ TEOM Monitoring – DES discontinued $PM_{2.5}$ TEOM monitoring at this station during October 2009. DES installed a BAM at this station During January 2008; from then until October 2009 DES operated two continuous methods for $PM_{2.5}$ monitoring (BAM and TEOM). DES evaluated the costs and benefits of operating two continuous $PM_{2.5}$ samplers at this station, and decided to discontinue the TEOM. A key element of this decision was based on limited space in the station.

Moose Hill School, Londonderry

– Constructed energy efficient station for NCore at the Moose Hill School in Londonderry - DES designed and managed a super insulated, solar supplemented structure at the Moose Hill School in Londonderry. Specifics regarding the construction of this station are as follows:

Whenever and wherever possible, DES and (or) the contractor utilized 'green - environmentally sustainable' construction practices to follow Leadership in Energy and Environmental Design (LEED) standards. DES specifically solicited contractor suggestions regarding green materials and construction practices.

- The Station is a 12' by 16' (outside dimensions) insulated structure with cathedral ceiling. The interior has two rooms (per plan) separated by an insulated wall. The interior wall has a 6' glass sliding door (E4 insulation).
- The climate control system is capable of heating and cooling the Station, using separately controlled thermostats for each room, to maintain relatively constant temperatures near 75 degrees Fahrenheit (± 1°) throughout all seasons.
- The insulation values (in R-Value) are as follows:
    - Ceiling/attic – 38/49
    - Wall Sheathing – 5
    - Wall Cavity – 21

  - Floor – 30
- The Station has two insulated exterior doors with 6 pane gas filled glass windows. It does not have any other windows.

DES oversaw installation of an 1800 watt solar photovoltaic system on this stations' south facing roof. The solar system is not expected to furnish all of the electricity use for the Station, but to supplement it. A key purpose of the solar system is to serve as an educational component to the Station. The solar system is a Grid Tied System, integrated with PSNH grid power to allow for potential credits with excess electricity generated.

Portsmouth, Pierce Island

– Installed, Operated and Replaced TEOM with a Continuous $PM_{2.5}$ BAM – DES installed a BAM at this station during January 2010. DES sought out and received EPA permission for this unplanned change. DES evaluated the costs and benefits of operating two continuous $PM_{2.5}$ samplers at this station, and decided to discontinue the TEOM. Key elements resulting in this move relate to the waning performance of the TEOM and the Federal Equivalency Designation for the BAM.

Beta Attenuation Federal Equivalency Method (FEM) Monitoring

DES has implemented FEM continuous (hourly) PM2.5 sampling at several stations with the MET ONE BAM. To date, DES operates BAMs at the Lebanon, Keene and Portsmouth stations. DES plans on adding BAMs at both NCore stations, but has funding for only one at the present time. Wherever DES operates a BAM, the resultant data, once validated, will be used as secondary - toward PM2.5 NAAQS compliance determination - to any FRM data generated at the same site and time. FRM data will be primary, where and when available.

DES covers pre-July 1, 2009 modification information in previous Annual Network Review Plans, respectively.

Future Plans

In concert with NCore, DES is studying further consolidation and streamlining of the monitoring network and plans to implement several changes during the upcoming year – July 2010 through June 2011:

Londonderry, Moose Hill School

- Establish NCore – On October 30, 2009, EPA approved the Moose Hill School site in Londonderry as one of DES's NCore stations. DES is developing this station and plans to have it fully operational by January 1, 2011. DES intends to relocate most parameters from the Manchester, Pearl Street station to the Londonderry station except for a carbon monoxide analyzer and a TEOM. DES is also planning on establishing this station as an IMPROVE site. Please see individual station information on page 77 for a list of specific NCore parameters.

Manchester, Elm Street

– Establish Microscale Site for Carbon Monoxide – DES intends to find a suitable microscale CO location in Manchester before June 2011. Until then, DES intends to operate the CO analyzer at our Pearl Street station. CO monitoring in Manchester acts as a triggering mechanism for the Nashua CO maintenance area. DES intends to work with EPA to find a more suitable CO monitoring location in downtown Manchester.

Manchester, Pearl Street
- **Discontinue Nitrogen Dioxide, Sulfur Dioxide, PM10 and PM10 collocation –** DES will discontinue these parameters in coordination with starting up trace level parameters at the NCore station in Londonderry. DES intends to initiate PM10 collocation at our station in Portsmouth.
– **Continue Operation of PM2.5 TEOM -** DES will maintain the TEOM at the Pearl Street location for an indefinite period of time.

Nashua, Crown Street
- Alter PM2.5 Filter Based Sampling Frequency – DES intends to alter the PM2.5 FRM (filter based) sampling frequency from once every three days to once every 6 days at this station. DES plans on enacting this frequency reduction on January 1, 2011. Due to the establishment of the Londonderry NCore station and its associated robust PM monitoring scheme, DES feels that it is appropriate to reduce the PM2.5 sampling in Nashua to once every 6 days. Further supporting this decision is the fact that DES has an extremely aged network of filter based samplers that continually demand attention and malfunction. By lessening the frequency at this station, DES will be able to reduce the total number of samplers needed by one.

Peterborough, Pack Monadnock
- Establish NCore - On October 30, 2009, EPA approved the Pack Monadnock site in Peterborough as one of DES's NCore stations. DES is remodeling our existing station on Pack Monadnock for NCore and plans to have it fully operational by January 1, 2011. Until more funding is available, DES will conduct $PM_{2.5}$ continuous monitoring on Pack Monadnock with an 8500AB TEOM run at 50 degrees Celsius (hot TEOM). DES is hoping to procure funding to purchase a Met One BAM FEM to replace the TEOM in the future. Please see individual station information on page 78 for a list of specific NCore parameters.
– **Constructing an efficient station for NCore –** DES intends to modify the Old State Police Building at base of the fire tower on Pack Monadnock Mountain to meet NCore monitoring needs. We anticipate the construction phase for this project will last approximately 30 days; it will start in August 2010 and be completed in September 2010. The pre-existing structure is approximately 27.5' long by 10' wide and sets on a multi-tiered concrete and rock slab. The finished floor plan will include three rooms, one each for UNH (University of New Hampshire), PAMS (Photochemical Air Monitoring Station) and NCore. DES will continue to operate the ozone monitor during construction and ensure the final design meets siting criteria, to the maximum extent practicable

Portsmouth, Pierce Island
- **Alter PM2.5 Filter based sampling Frequency** – DES intends to alter the PM2.5 FRM (filter based) sampling frequency from once every three days to once every 12 days. As described in Item #3 in the Network Modifications section above, DES replaced a TEOM with a BAM at this station during January 2010. The BAM is considered a Federal Equivalent Method for PM2.5 and will be considered DES' primary monitor at this station when the frequency reduction takes place. DES plans on enacting this frequency reduction on January 1, 2011.
- **Initiate PM10 collocation sampling** – DES intends to initiate PM10 collocation sampling, every 6 days, in concert with discontinuing PM10 collocation sampling in Manchester – as part of overall NCore implementation.

Lead Monitoring – DES intends to initiate lead monitoring in concert with regulatory requirements, yet to be determined. The proposed lead monitoring rule changes the CBSA based requirements to require lead monitoring only at NCore monitoring sites, and even further, possibly only at urban NCore sites. DES intends to utilize low volume PM10 teflon filters for lead analyses (x-ray florescence - XRF) to fulfill pending lead monitoring requirements.

Near Roadway NO2 Monitoring – DES intends to initiate "near roadway" NO2 monitoring in coordination with Massachusetts to fulfill recently promulgated regulatory requirements (NO2 NAAQS rule – January 22, 2010). According to this rule, DES or Massachusetts is obligated to site two NO2 monitors under the "near roadway" criteria in the multistate area of Boston, MA – NH. DES intends to have any new NO2 required monitoring, under this rule, operational by January 1, 2013.

SO2 Monitoring – DES intends to modify the current SO2 monitoring network, if necessary, to fulfill recently promulgated regulatory requirements (SO2 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 SO2 monitoring regulations. The current network infrastructure may be adequate. None-the-less, DES intends to have any new SO2 required monitoring, under this rule, operational by January 1, 2013.

Purchasing/Expenses

DES' budget cycle runs from July 1 through June 30 each year. From July 1, 2009 through June 30, 2010 DES has purchased (or is in the procurement process for) the following equipment: an ultrasonic meteorological sensor, a total organic carbon generator, an electronic chart recorder, digital port servers, jib cranes, 15 regulators, 6 trace analyzers, 2 NOy analyzers, a beta attenuation monitor, a ESC data logger and 2 sequential filter based samplers. DES also expends considerable funding on 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 attention in order to provide adequate data. In fact, most of DES' filter based particle samplers are in dire need of replacement. Table 1.1 presents equipment, analyzers and samplers that DES currently uses for ambient air quality monitoring.

DES has spent considerable funds contracting for and overseeing the construction of a highly efficient air monitoring structure at the Moose Hill School in Londonderry. This is one of DES' NCore (National Core) Stations. DES contracted for installation of an energy efficient heating and cooling system and a photovoltaic system. The solar system will help supplement the energy used at the station.

DES also plans to expend sufficient funding in order to upgrade an existing air monitoring site on Pack Monadnock Mountain to establish infrastructure for DES' 2nd NCore Station.

DES covers pre-July 1, 2009 purchasing and expense information in previous Annual Network Review Plans, respectively.

Cooperative Air Monitoring Initiatives

DES is involved in cooperative air monitoring initiatives with UNH and the Appalachian Mountain Club. This joint initiative monitors ozone at the summits of Pack Monadnock Mountain, Mount Washington, and Camp Dodge (located at the base of Mt. Washington). DES continues to coordinate efforts with UNH to monitor specific trace-level parameters at the summit of Pack Monadnock.

DES is partnering in a Challenge Cost Share Agreement with the United States Department of Agriculture (Forest Service) 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. This agreement ensures the stability of the Camp Dodge station until May 1, 2011. DES intends to work with the Forest Service to renew the Challenge Cost Share Agreement for this site by May 2011. The Forest Service operates an IMPROVE (Interagency Monitoring of Protected Visual Environments) sampler at this site. DES currently maintains ozone sampling, upkeep and routine site inspections at this station.

DES provides critical 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 the closing of a public beach and alerts of possible bacterial dangers. A similar system is in place to enact erosion control inspections at a New Hampshire Department of Transportation road construction projects near Nashua, NH; this system utilizes rainfall data from DES' station at Gilson Road in Nashua.

Monitoring Trends

Each year, DES reviews its monitoring data and calculated design values for comparison to the National Ambient Air Quality Standards (NAAQS). These standards are established 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 4th 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 1.15 present monitoring trends for the key criteria pollutants for the period 1997 through 2009. In all cases, air quality is significantly improved from the 1970s and 1980s. Currently monitored levels of sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO) are safely below the current levels of the NAAQS. However, the NAAQS for ozone and $PM_{2.5}$ has 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 NO_2, SO_2 and lead are also either being lowered or proposed to be lowered. New Hampshire does not currently monitor for lead, but historical monitoring in the state suggest that lead concentrations are now well below the proposed new NAAQS. Current monitoring for NO_2 indicates New Hampshire also meets the level of the new 1-hour NAAQS, although, the New Hampshire network does not yet include a road-side NO_2 monitor.

EPA recently adopted a new SO2 1-hour NAAQS of 0.075 ppm. While New Hampshire's SO2 levels safely meet the 3-hour, 24-hour, and annual NAAQS, the attainment status for the new 1-hour SO_2 NAAQS is questionable at the moment. Current monitoring indicates some locations are above the 0.075 ppm threshold. However, much of the elevated levels of SO_2 are 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 1.11 through 1.14 provide the five-year maximum and most recent (2009) design values for each criteria pollutant. These are also expressed as percentages of the current NAAQS. CO and NO2 design values are all under 50% of the NAAQS. This is also true of the 3-hour and annual SO2 design values, and the 24-hour SO2 design value stays under 60% of the NAAQS. However, the highest SO2 site, Pembroke, does exceed more than twice the NAAQS in 2009. Also, with the lower ozone standard of 0.075 ppm, some New Hampshire sites, namely Pack Monadnock summit and Rye, just barely exceed the standard, by no more than 7%.
New Hampshire operates two Photochemical Assessment Monitoring Stations (PAMS): Pack Monadnock and Nashua. Tables 1.5 and 1.6 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/m3. At Pack Monadnock, the maximum 24-hour average for benzene over the full period was 0.41 ug/m3, which is about 7% of the AAL. At Nashua, benzene's maximum value was 0.74 ug/m3, or 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	
	1.5 µg/m^3	Quarterly 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	
	0.12 ppm	1-hour [(10)]	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Average)	0.5 ppm	3-hour [(1)]
	0.14 ppm	24-hour [(1)]		
	75 ppb [(11)]	1-hour	None	

[(1)] Not to be exceeded more than once per year.
[(2)] Final rule signed October 15, 2008.
[(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/m3.
[(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/m3 (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) EPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1.
[(11)] (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: Equipment – (Method)
SO_2
Teledyne – API 100A – (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)
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)
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 Gas Calibrators
Teledyne – API Model 700E Gas Calibrators
Environics Series 6103 Multi Gas Calibrator
Data Acquisition System
Environmental Systems Corporation (ESC) Data Loggers 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

Table 1.3: Ozone Design Values

Ozone (ppb)	Design Value Description	NAAQS	5-Year Max	% of NAAQS	Location	2009 Max	% of NAAQS	Location
8-Hour	3-year average of 4th-highest daily maximum 8-hour averages	75	80	107%	Pack Monadnock	76	101%	Rye & Pack Monadnock

Table 1.4: Carbon Monoxide Design Values

CO (ppm)	Design Value Description	NAAQS	5-Year Max	% of NAAQS	Location	2009 Max	% of NAAQS	Location
1-Hour	2nd maximum	35	9.1	26%	Nashua	3.2	9%	Manchester
8-Hour	2nd maximum	9	3.5	39%	Manchester	2	22%	Manchester

Table 1.5: Sulfur Dioxide Design Values

SO2 (ppm)	Design Value Description	NAAQS	5-Year Max	% of NAAQS	Location	2009 Max	% of NAAQS	Location
1-Hour	3-year average of 99th percentile of daily maximum 1-hour averages	0.075	0.173	231%	Pembroke	0.173	231%	Pembroke
3-Hour	2nd maximum	0.5	0.20	41%	Pembroke	0.20	40%	Pembroke
24-Hour	2nd maximum	0.14	0.083	59%	Pembroke	0.083	59%	Pembroke
Annual	Annual average	0.03	0.008	28%	Pembroke	0.008	28%	Pembroke

Table 1.6: Nitrogen Dioxide Design Values

NO2 (ppb)	Design Value Description	NAAQS	5-Year Max	% of NAAQS	Location	2009 Max	% of NAAQS	Location
1-Hour	3-year average of 98th percentile of daily maximum 1-hour averages	100	46	46%	Manchester	46	46%	Manchester
Annual	Annual average	53	11	21%	Manchester	10	19%	Manchester

Figure 1.5: Ozone trends for the 8-Hour NAAQS (1997-2009)

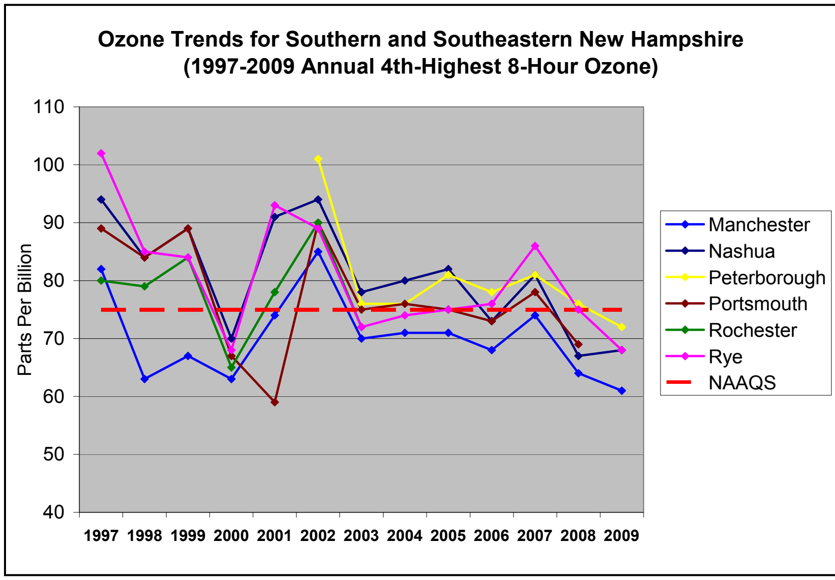


Figure 1.6: Ozone trends for the 8-Hour NAAQS (1997-2009)

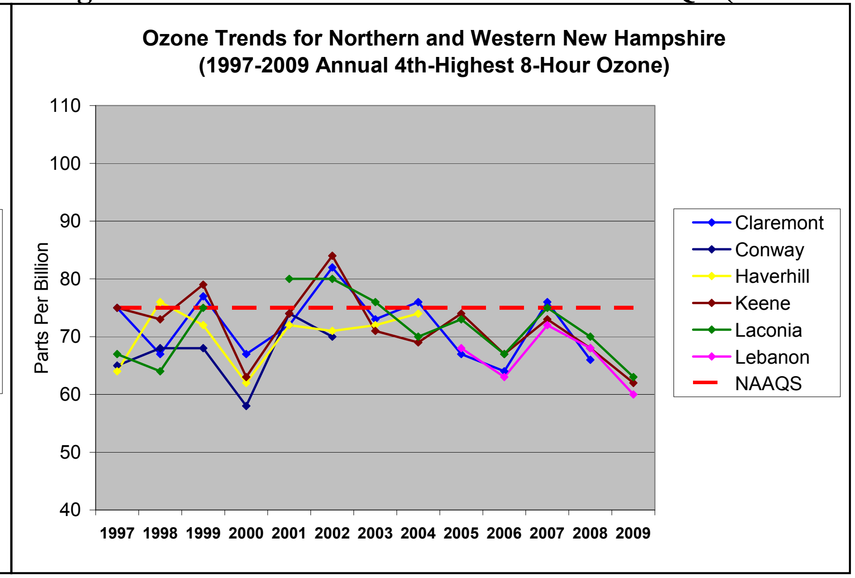


Figure 1.7: Carbon Monoxide trends for the 1-hour NAAQS (1997-2009)

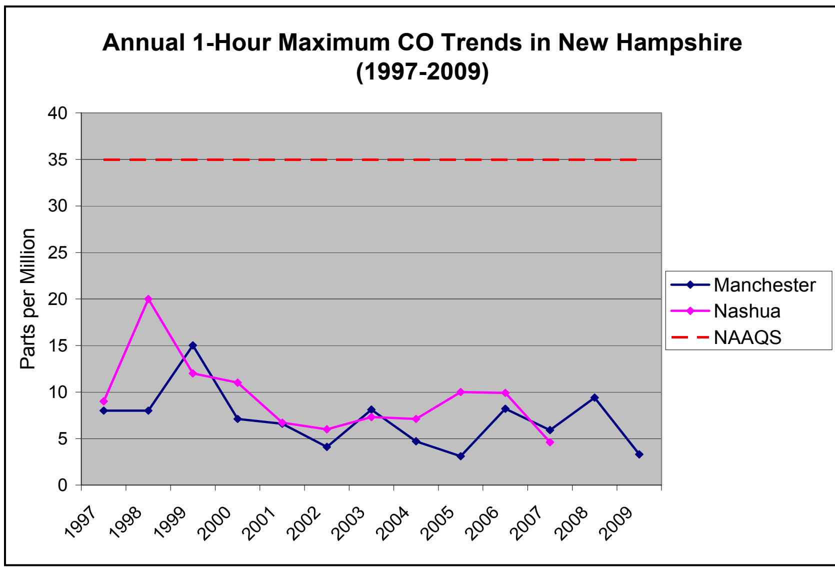


Figure 1.8: Carbon Monoxide trends for the 8-hour NAAQS (1997-2009)

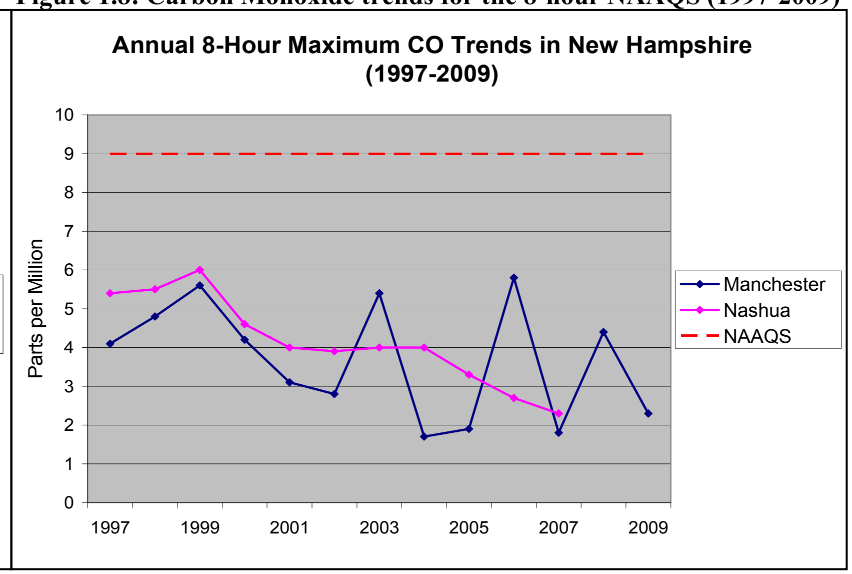


Figure 1.9: PM2.5 trends for the 24-Hour (2001-2009)

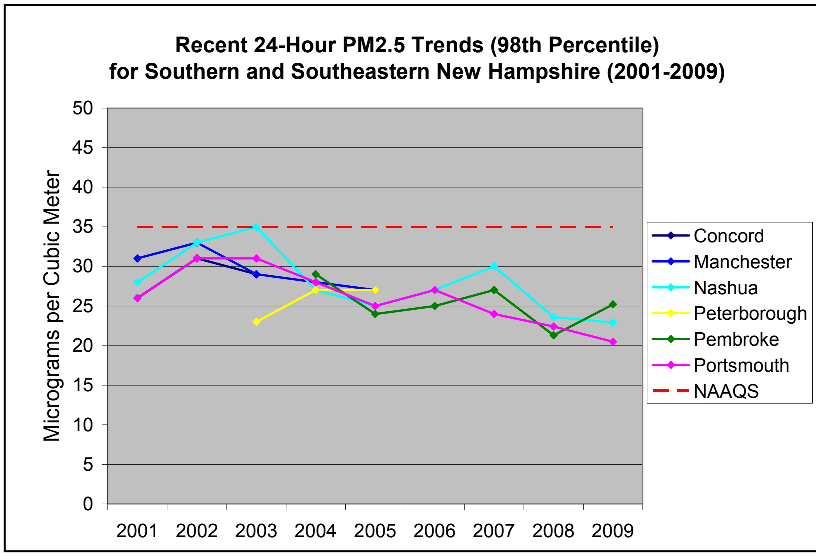


Figure 1.10: PM2.5 trends for the 24-Hour NAAQS (2001-2009)

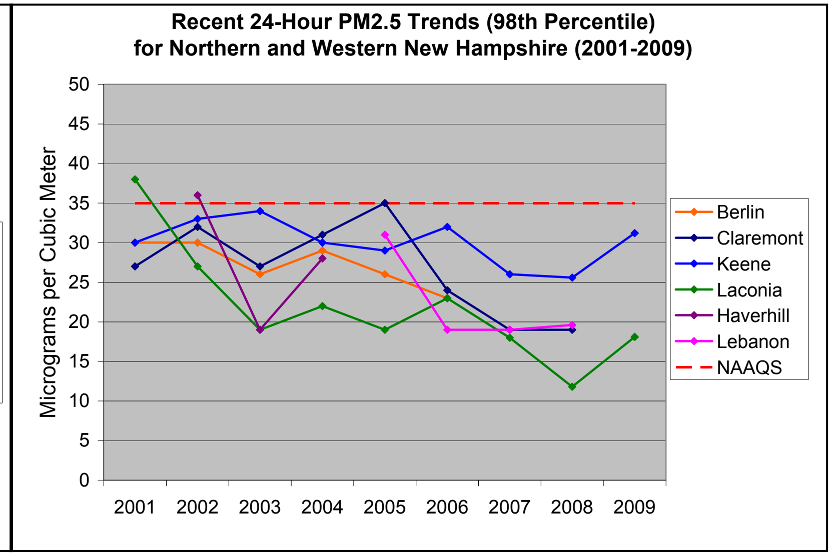


Figure 1.11: PM2.5 trends for the annual NAAQS (2001-2009)

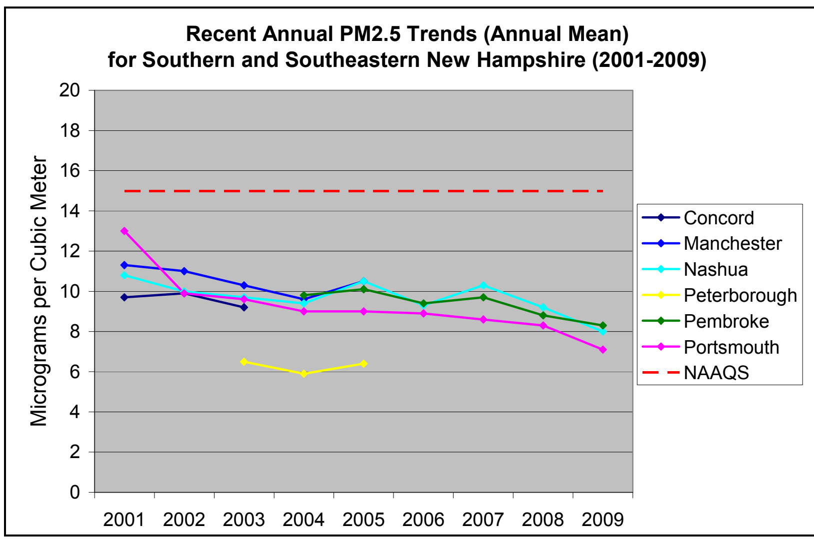


Figure 1.12: PM2.5 trends for the annual NAAQS (2001-2009)

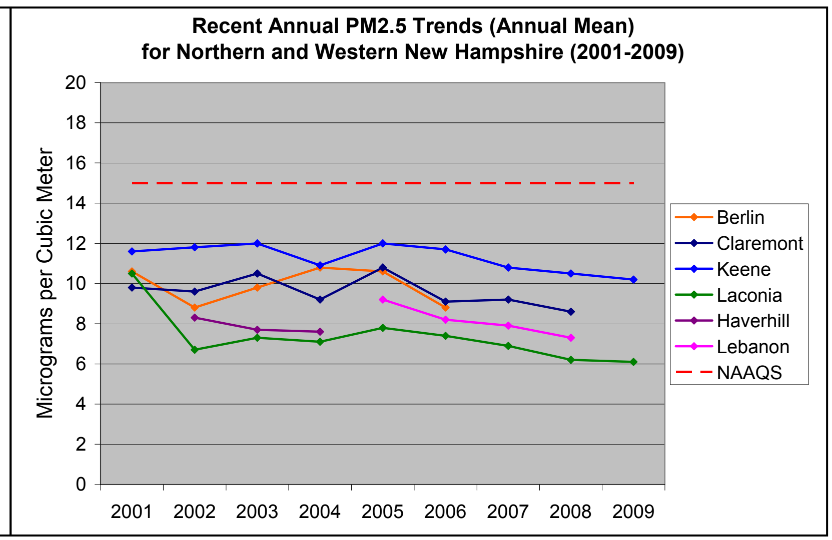


Figure 1.13: Nitrogen Dioxide trends for the annual NAAQS (2001-2009)

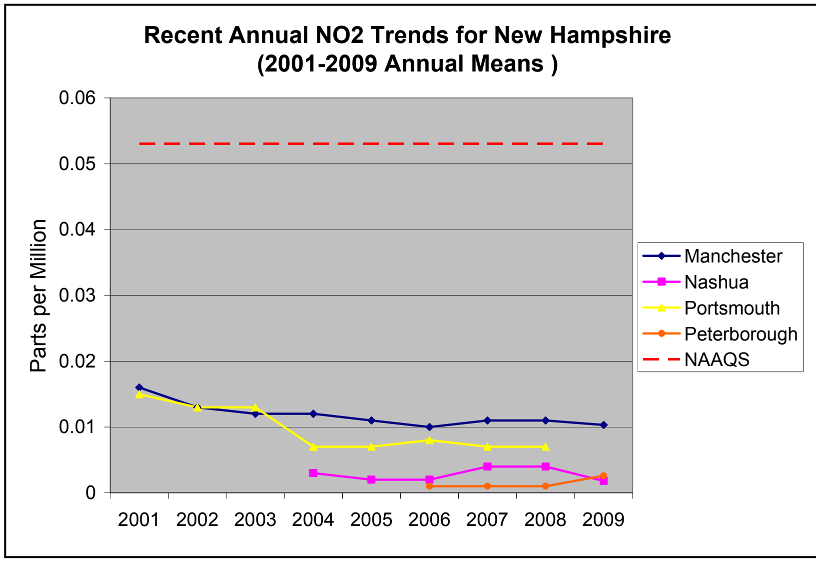


Figure 1.14: Sulfur Dioxide trends for the 3-Hour NAAQS (2001-2009)

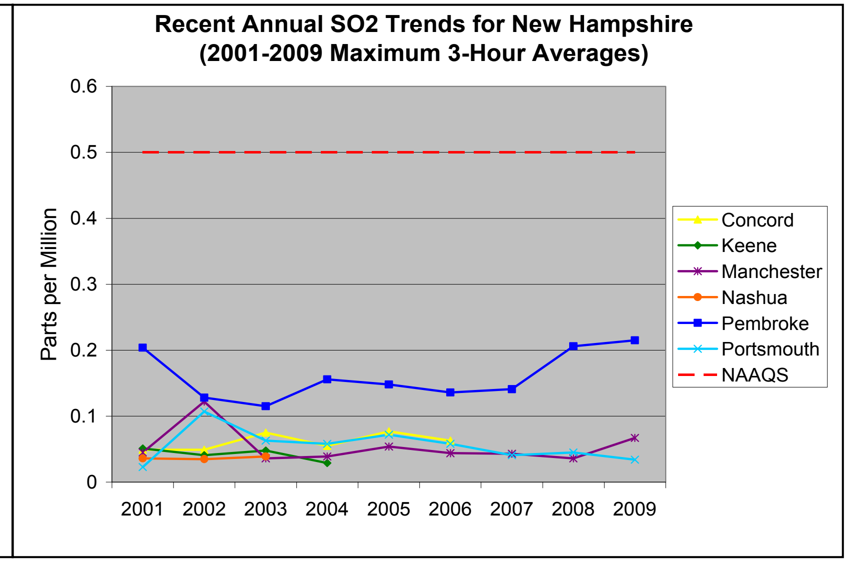
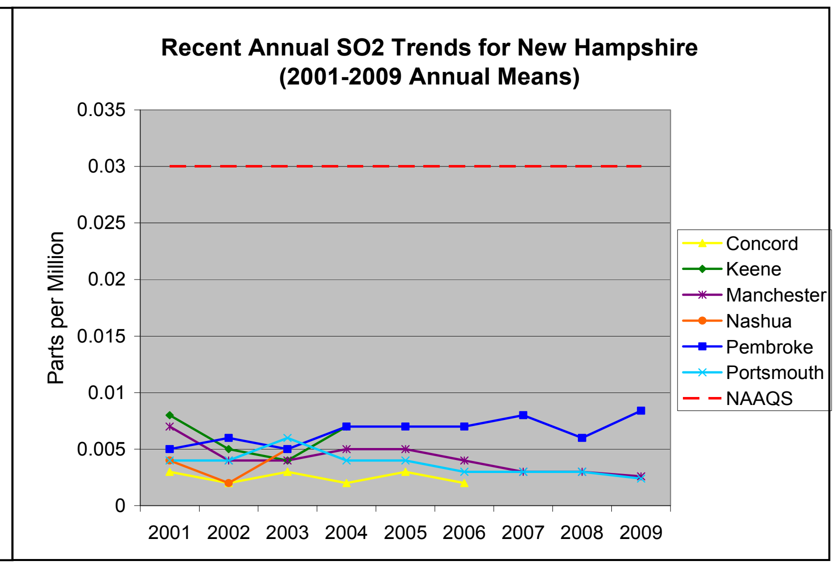


Figure 1.15: Sulfur Dioxide trends for the 24-hour NAAQS (2001-2009)

Figure 1.16: Sulfur Dioxide trends for the annual NAAQS (2001-2009)



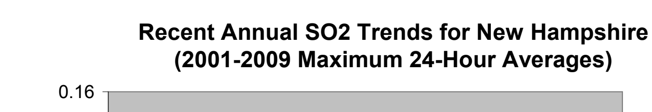


Figure 1.17: Nitrogen Dioxide trends for the 1-hour NAAQS (2001-2009)

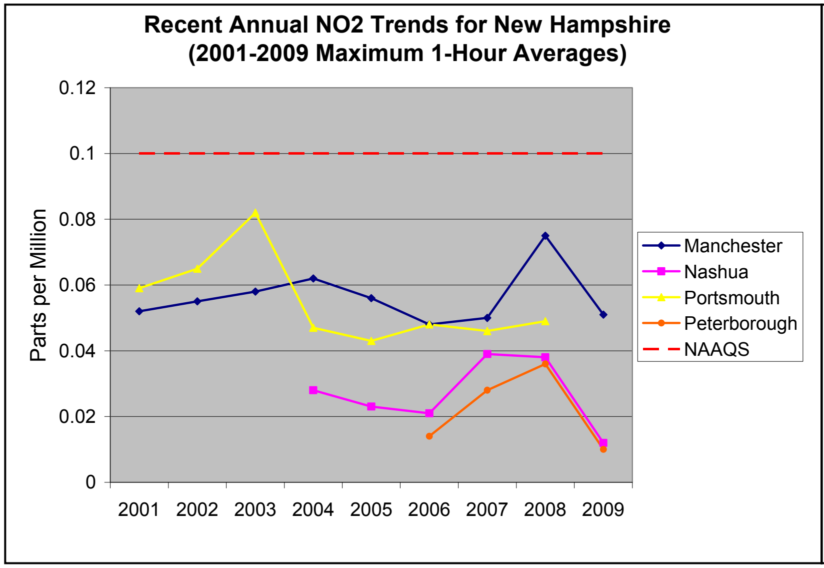


Figure 1.18: Sulfur Dioxide trends for the 1-hour NAAQS (2001-2009)

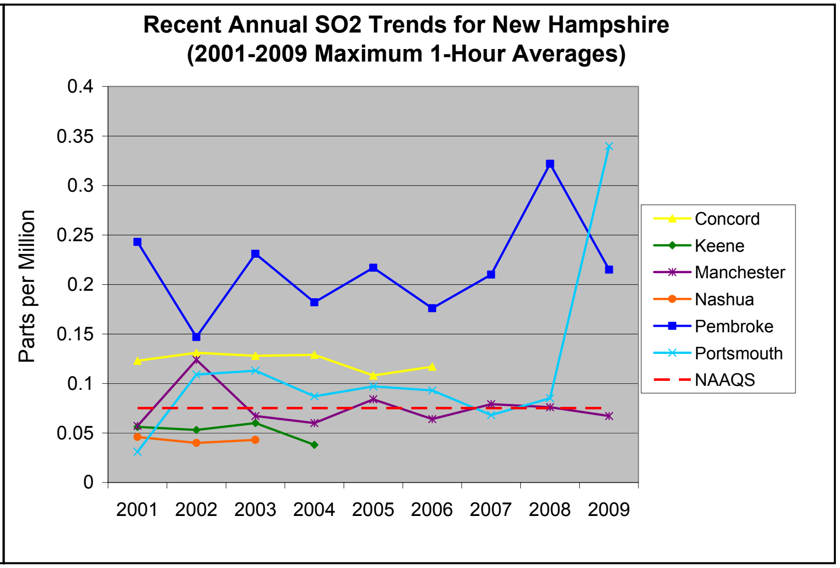


Table 1.7: New Hampshire State and Local Air Monitoring Stations Network – 2009/2010					
SO_2					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Manchester	Pearl Street	33 011 0020	Continuous	Urban	Population
Pembroke	Pembroke Highway Dept.	33 013 1006	Continuous	Neighborhood	High Concentration
Portsmouth	Pierce Island	33 015 0014	Continuous	Neighborhood	Population
CO					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Manchester	Pearl Street	33 011 0020	Continuous	Middle	High Concentration
O_3					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Concord	Hazen Drive	33 013 1007	Continuous	Neighborhood	Population
Greens Grant	Camp Dodge	33 007 4002	Continuous	Regional	Research
Keene	Water Street	33 005 0007	Continuous	Neighborhood	Population
Laconia	Lakes Region	33 001 2004	Continuous	Regional	Population
Lebanon	Lebanon	33 009 0010	Continuous	Neighborhood	Population
Manchester	Pearl Street	33 011 0020	Continuous	Urban	Population
Mount Washington	Mt. Washington Summit	33 007 4001	Continuous	Regional	Research
Nashua	Gilson Road	33 011 1011	Continuous	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	Continuous	Neighborhood	High Concentration
NO_2					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Manchester	Pearl Street	33 011 0020	Continuous	Urban	High Concentration
Nashua	Gilson Road	33 011 1011	Continuous	Neighborhood	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research

Table 1.8: New Hampshire PM Network 2009/2010					
$PM_{2.5}$					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Keene	Water Street	33 005 0007	1 in 6	Neighborhood	Population
Keene	Railroad Street	33 005 0007	Continuous	Neighborhood	Population
Laconia	Green Street	33 001 2004	1 in 6	Regional	Population
Lebanon	Lebanon Airport	33 009 0010	Continuous	Neighborhood	Population
Manchester	Pearl Street	33 011 0020	Continuous	Urban	Population
Nashua	Crown Street	33 011 1015	1 in 3	Urban	High Concentration
Pembroke	Pembroke Highway Dept.	33 013 1006	1 in 3	Neighborhood	High Concentration
Pembroke	Pembroke Highway Dept.	33 013 1006	1 in 6	Neighborhood	Audit
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research
Portsmouth	Pierce Island	33 015 0014	1 in 3	Neighborhood	Population
Portsmouth	Pierce Island	33 015 0014	Continuous	Regional	Population
$PM_{2.5}$ Speciation					
Peterborough	Pack Manadnock	33 011 5001	1 in 3 IMPROVE	Regional	Research
PM_{10}					
Manchester	Pearl Street	33 011 0020	1 in 6	Urban	Population
Manchester	Pearl Street	33 011 0020	1 in 6	Urban	Audit
Portsmouth	Pierce Island	33 015 0014	1 in 6	Neighborhood	Population

Table 1.9: New Hampshire PAMS Network – 2009/2010					
Town	**Name**	**AIRS #**	**Frequency**	**Scale**	**Objective**
Nashua	Gilson Road	33 011 1011	Continuous	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Continuous	Regional	Research

Table 1.10: New Hampshire's Future NCore Network					
Town	**Name**	**AIRS #**	**Status**	**Scale**	**Objective**
Londonderry	Moose Hill School		Operational by Jan 1, 2011	Regional	Population
Peterborough	Pack Monadnock	33 011 5001	Operational by Jan 1, 2011	Regional	Research

Table1.11: Seasonal Maximum 24-hour Averages at Gilson Road in Nashua for Toxic PAMS Species Compared to the Ambient Allowable Limit (AAL), 2005-2009

PAMS Parameter	AAL ug/m3	Max 24 Hour Avg. (ug/m3)					Max as % of AAL
		2005	2006	2007	2008	2009	
PROPYLENE (43205)	35,833	0.55	0.34	0.30	0.33	0.35	0.00%
CYCLOPENTANE (43242)	25,595	0.23	0.23	0.16	0.13	0.15	0.00%
ISOPENTANE (43221)	36,875	2.04	2.50	1.56	1.41	1.23	0.01%
PENTANE (43220)	36,875	3.13	1.39	0.85	0.74	0.76	0.01%
2-METHYLPENTANE (43285)	36,875	0.60	0.78	0.21	0.35	0.25	0.00%
3-METHYLPENTANE (43230)	36,875	0.41	0.48	0.20	0.30	0.20	0.00%
HEXANE (43231)	885	0.59	0.58	0.47	0.74	0.51	0.08%
BENZENE (45201)	5.7	0.51	0.74	0.36	0.42	0.37	12.91%
CYCLOHEXANE (43248)	6,000	0.25	0.21	0.21	0.48	0.19	0.01%
HEPTANE (43232)	8,249	0.56	0.34	0.18	0.32	0.25	0.01%
METHYLCYCLOHEXANE (43261)	23,958	0.21	0.21	0.11	0.16	0.10	0.00%
TOLUENE (45202)	5,000	2.37	2.67	1.39	1.97	1.60	0.05%
OCTANE (43233)	7,000	0.32	0.13	0.10	0.13	0.09	0.00%
ETHYLBENZENE (45203)	1,000	0.36	0.36	0.18	0.39	0.57	0.06%
M & P-XYLENES (45109)	1,550	0.88	0.96	0.68	1.15	2.04	0.13%
STYRENE (45220)	1,000	0.88	0.13	0.22	0.07	0.06	0.09%
O-XYLENE (45204)	1,550	0.32	0.36	0.26	0.40	0.40	0.03%
NONANE (43235)	15,625	0.21	0.13	0.21	0.10	0.11	0.00%
1,3,5-TRIMETHYLBENZENE (45207)	619	0.11	0.12	0.09	0.32	0.17	0.05%
1,2,4-TRIMETHYLBENZENE (45208)	619	0.32	0.39	0.32	0.39	0.31	0.06%

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), 2006-2009

PAMS Parameter	AAL (ug/m3)	Max 24-Hour Avg. (ug/m3)				Max as % of AAL
		2006	2007	2008	2009	
PROPYLENE (43205)	35,833	0.28	0.25	0.46	0.15	0.00%
CYCLOPENTANE (43242)	25,595	0.42	0.53	1.63	0.29	0.01%
ISOPENTANE (43221)	36,875	1.03	1.09	0.70	0.89	0.00%
PENTANE (43220)	36,875	45.41	7.63	0.55	0.45	0.12%
2-METHYLPENTANE (43285)	36,875	0.19	0.27	0.04	0.06	0.00%
3-METHYLPENTANE (43230)	36,875	0.13	0.17	0.01	0.04	0.00%
HEXANE (43231)	885	0.21	0.27	0.19	0.32	0.04%
BENZENE (45201)	5.7	0.31	0.33	0.32	0.41	7.21%
CYCLOHEXANE (43248)	6,000	0.14	0.05	0.02	0.08	0.00%
HEPTANE (43232)	8,249	0.71	0.16	0.15	0.17	0.01%
METHYLCYCLOHEXANE (43261)	23,958	1.23	0.15	0.15	0.11	0.01%
TOLUENE (45202)	5,000	1.00	1.05	1.11	1.01	0.02%
OCTANE (43233)	7,000	0.91	0.17	0.27	0.11	0.01%
ETHYLBENZENE (45203)	1,000	0.35	0.20	0.59	0.21	0.06%
M & P-XYLENES (45109)	1,550	1.88	0.37	2.38	0.46	0.15%
STYRENE (45220)	1,000	1.03	1.13	1.80	0.40	0.18%
O-XYLENE (45204)	1,550	0.60	0.13	0.67	0.15	0.04%
NONANE (43235)	15,625	8.83	1.33	0.57	0.23	0.06%
1,3,5-TRIMETHYLBENZENE (45207)	619	1.75	0.08	0.29	0.13	0.28%
1,2,4-TRIMETHYLBENZENE (45208)	619	3.91	1.34	0.79	0.53	0.63%

Part 2: 5 Year Network Assessment

DES respectfully presents this 5 Year Network Assessment in accordance with the *Code of Federal Regulations Title 40, PART 58.* Again, DES would like to thank the United States Environmental Protection Agency (EPA) staff for working with DES to improve and maintain New Hampshire's Air Monitoring Network. In coordination with EPA, and in concert with our Annual Network Review Plans, DES has been persistently assessing and modifying the ambient monitoring network over the last 10 years. We are confident that the network is sufficient for NAAQS parameters. For this assessment, DES focused on PM2.5 and Ozone, two key risk parameters in New Hampshire. DES will assess the SO2, NO2 and Lead monitoring networks, as appropriate, once EPA finalizes the respective regulations and plans for those parameters.

Monitoring Objectives

In the interest of public health and the environment, DES operates a network of air monitoring sites throughout the state. These sites facilitate monitoring of ambient ozone, sulfur dioxide, nitrogen dioxide, certain air toxics, volatile and semi-volatile organic compounds, carbon monoxide and particulate matter levels.

DES' mission is "to help sustain a high quality of life for all citizens by protecting and restoring the environment and public health in New Hampshire". Air monitoring data from DES' network helps determine the status of air quality coming into New Hampshire from areas upwind, predict air pollution episodes, enact protective actions and warnings, develop emission reduction strategy, assess effectiveness of emission reduction strategies, supports health assessments and supports NAAQS reviews.

Network Assessment Analyses and Tools

Michael Rizzo of EPA developed a set of tools to help states assess whether to remove or add sites in their ozone and particulate matter monitoring networks. Specifics for each tool follow:

- Population Animation Tool
  - Input: Census population estimates
  - Output: Google Earth map of population changes 1990-2008
  - Purpose: Identify areas of stagnant, decreasing, or increasing population growth to determine whether monitoring locations should be re-evaluated for best representation of current and future population centers
- Correlation Matrix Tool
  - Input: 2005-2008 monitoring data (after accounting for data completeness)
  - Output: Creates a matrix comparing each site with the selected area to every other site and reports the average relative difference in concentration and the R2 correlation factor for each site pair
  - Purpose: Identify redundant sites for removal or unique sites that should be preserved
- Area Served Tool
  - Input: 2000 Decennial Census and 2005-2008 Census population estimates; list of site locations provided by user; tract boundaries based on Voronoi (also called Thiessen) polygons
  - Output: Estimates the area covered by each site and, drawing from Census population data, the number of people within that area.

    - Purpose: May input actual or proposed network of sites to see how the population and area served is represented by current sites or would be altered by changes in the network
- New Sites Tool
    - Input: 2005-2008 monitoring data (after accounting for data completeness)
    - Output: Suggests locations of new sites by interpolating between site pairs that meet certain criteria (thresholds may be changed by user):
        - R2 correlation (default <0.5)
        - Distance between sites (default >=100 km)
        - Average concentration difference (default >=0)
        - Probability of exceeding 85% of NAAQS (default >=80%)
    - Purpose: Identify locations in which a new site might succeed in filling a gap in the network, based on the above considerations
- Removal Bias Tool
    - Input: 2006-2008 monitoring data (after accounting for data completeness)
    - Output: The result of the analysis provides the available design value, as an indicator of concentrations at the site, and an average bias. The average bias is the difference in concentration between what would have been interpolated based on surrounding monitors if the monitor did not exist versus what has actually been measured there.
    - Purpose: Helps determine whether, without a specific monitor, the area's pollutant levels would be over- or under-estimated by the remaining neighboring monitors.

The following presents each tool's output for New Hampshire ozone and PM2.5 sites. Results are described individually. Additional follow-up analyses might involve rerunning some tools under different scenarios and connecting the results of each tool to determine their combined implications. However, these tools are designed only as a supplemental aid to network assessment. Even taken together, they do not account for many important factors, such as topography, historical value, and other considerations.

Population Animation Tool

The population animation tool does not require any user inputs, except to select the type of monitors to display over the background map. The Google Earth map color codes each census tract by change in population since 1990. The user may set the map in motion or, using a slider, select any time between 1990 and the end of 2008 to get a still shot of the changes to that point.

Figures 2.1 and 2.2 represent maps of the 1990-2008 population changes overlayed with ozone monitors and PM2.5 (continuous and FRM) monitors, respectively.

Each map shows two categories of monitors: active (as of late 2008) and inactive (in use at some point since 1990, but no longer in operation). These are distinguished by circles (active) and triangles (inactive).

These maps highlight a few growing areas that may not be represented by the ozone and/or PM2.5 networks:

- Moultonborough (north end of Lakes Region). Notably, there has been relatively little change in Laconia, which has ozone and PM2.5 monitors, yet the most significant growth appears to be occurring further north on the other side of the lakes.
- Northeast/Northwest of Sunapee Lake. Two elongated swaths running west to east at the north edge of Sunapee Lake show elevated population growth compared to their surroundings. While the Lebanon site is not far west of the northwest portion, it lies at the outskirts in an area of much slower growth. Meanwhile, the closest sites to the east are much farther away (Laconia to the northeast and Concord/Pembroke to the southeast).
- Danville/Kingston Area: Northwest of a collection of small lakes (including Great Pond) is an area surrounded by the towns of Danville (to the southwest), Kingston (to the east), and Brentwood (to the north). This area stands out as having the highest growth rate of central Rockingham county, yet there are currently no monitors in the immediate vicinity.

Although Moultonborough is in an area of moderate growth compared to surrounding communities, figure 2.3 below shows that the 2000 Census population is centered elsewhere. Towns to the south of the lakes, such as Laconia, are much more populous than those to the north, including Moultonborough. Therefore, continued monitoring in Laconia is justified for serving the population of recent years.

Likewise, while the Sunapee Lake vicinity does show growth and does overlap a current swath of populated area stretching from the Vermont border, an equally populous area exists around Lebanon, where New Hampshire already operates a monitoring station. Thus, Lebanon does represent a significant population in this part of the state, and there should not be a need to duplicate this representation so nearby.

In the case of the Danville/Kingston area, however, there are no other monitors in the immediate vicinity to serve central Rockingham county. This area is both growing and currently well, though not heavily, populated. Monitors to the west provide for the highly urbanized cities of Manchester and Nashua, while monitors to the east cover the seacoast at Portsmouth and Rye. This suggests that there may be a gap at the intermediate inland locations where communities are expanding. New Hampshire does not presently have plans to add a monitor here, but recognizes the need to make further consideration on this point.

The Keene site seems to be positioned in an area of stagnant growth, but the overall county shows slow growth. Also, we know that this is the most populated town of the region. Moreover, it has the critically unique aspect of valley topography, which has been shown to lead to PM2.5 in the unhealthy for sensitive groups range during winter inversions when pollution primarily from woodsmoke becomes trapped in the valley bowl Efforts to study and address this issue include a Woodstove Changeout Campaign for the 2009-2010 season and additional special monitoring in Keene and surrounding areas. Monitoring at this site is important year-round and especially for tracking the number and severity of these winter events into the future.

Additionally, the maps show a decidedly decreasing population just inland of the Portsmouth area. Other than a tract in the far north, it is the only area of declining population in the state, despite being positioned near some of the largest and fastest growing communities of southeast and coastal New Hampshire.

Figure 2.1: Population Changes 1990-2008 (Ozone Monitors)

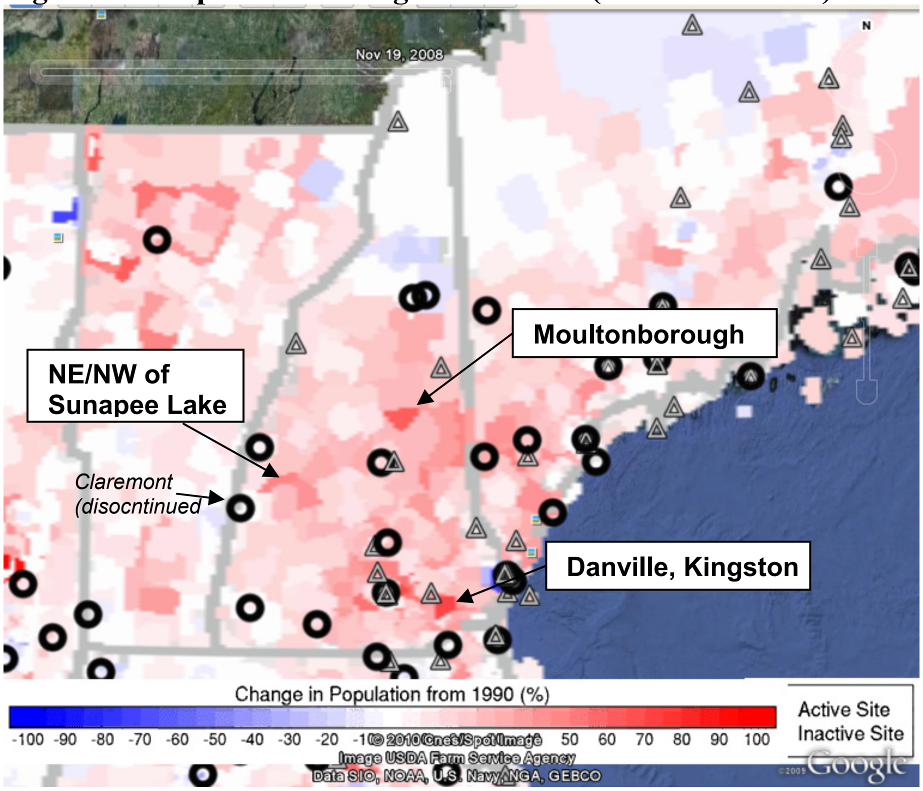


Figure 2.2: Population Changes 1990-2008 (PM2.5 Monitors)

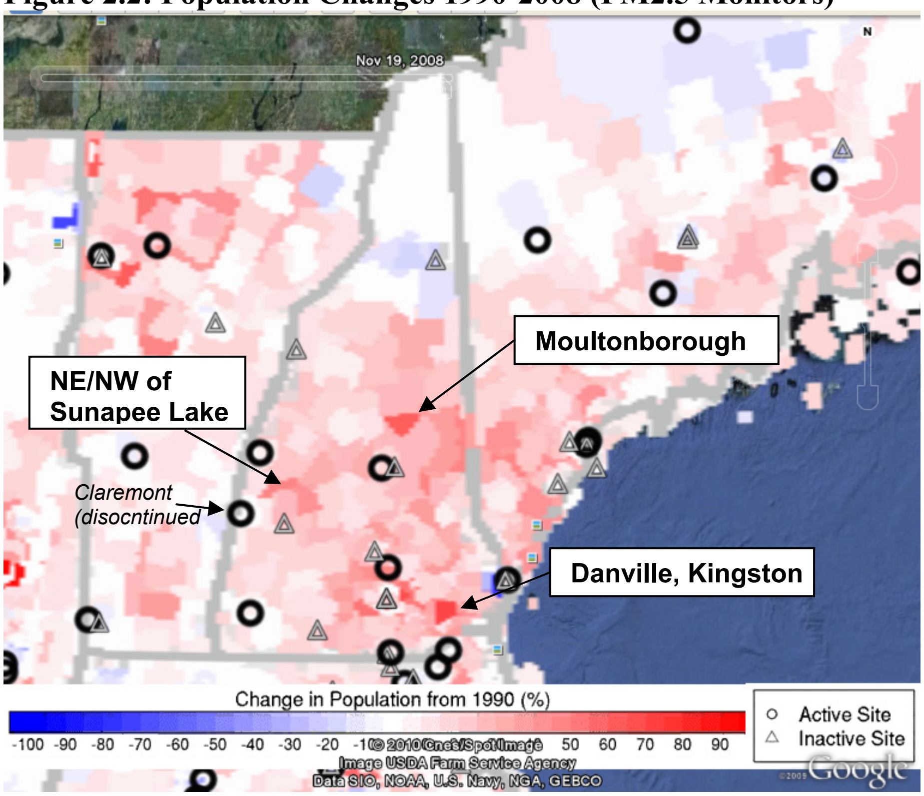
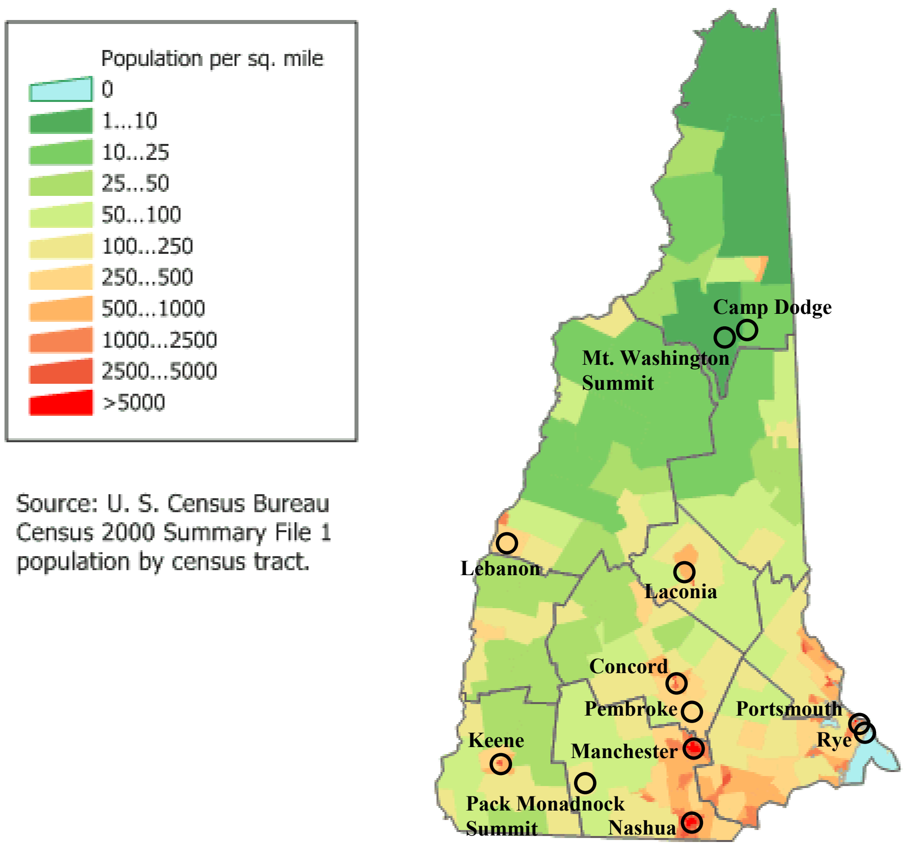


Figure 2.3: Population Density 2000



Correlation Matrix Tool

DES ran the correlation matrix tool for the following parameters:

- Continuous PM2.5 (2005-2008)
- 3-Day FRM PM2.5 (2005-2008)
- 6-Day FRM PM2.5 (2005-2008)
- Continuous Ozone (2005-2008)

Selection of the area is done by drawing a box on a map; thus, some sites from neighboring states appear in the final matrix. The output of this tool comes in a graphic and tabular format.

The matrix aligns each site in every possible pair with other sites in the selected area. In the graphical display, an ellipse is drawn for each site pair. Inside the ellipse is a number that represents the distance in kilometers between the sites. The shape of the ellipse indicates the degree of correlation: the more circular the shape, the worse the correlation (lower R2); the more ovular the shape, the better the correlation (higher R2); a straight line is a perfect correlation (R2=1). Finally, the filling color of the shape is illustrative of the average relative difference in concentration: the lighter the color, the lower the difference; the darker the color, the greater the difference.

This graphic output is meant to facilitate a visual assessment of which sites exhibit a unique role in the network and which may provide redundant information. Sites that consistently have a high correlation and low average relative difference compared to other sites may be redundant. Those that have a low correlation or high average relative difference to one or more other sites may occupy a niche in the air quality landscape.

Continuous PM2.5 – Correlation Matrix Tool – Figure 2.4, Table 2.1
Note that the only New Hampshire sites are Manchester, Portsmouth, and Pack Monadnock. Keene, Lebanon, and Camp Dodge were not available for analyses with this tool for reasons unknown. Most site pairs have a moderate correlation. The exception is a relatively low correlation (R2=0.4948) between Pack Monadnock and Portsmouth. Given the highly distinct geographic characteristics of these sites (inland, rural, high-elevation site compared to populated, coastal site), the lower correlation is expected.

All New Hampshire site pairs are relatively high on the relative difference scale. The greatest differences occur between Pack Monadock and the other two sites, Portsmouth and Manchester (0.5803 and 0.5163, respectively). However, Manchester versus Portsmouth also shows a considerable relative difference of 0.3247.

These results demonstrate that each of these three continuous PM2.5 sites are uniquely valuable to the network. Manchester represents an inland city, Portsmouth a coastal population center, and Pack Monadnock a rural summit. The significant relative difference in concentrations indicates that each represents various degrees of air quality levels. The particularly low correlation between Pack Monadnock and Portsmouth reveals that each is influenced by contrasting patterns in air quality sources, transport, and/or meteorology. These observations make sense as the summit may receive long-distance transport aloft, while Manchester experiences surface transport and the dynamics of localized emissions, and Portsmouth may be more likely to get a direct hit from a concentrated plume out of Boston or the accumulated off-shore air mass via a sea breeze. Thus, as the impact of any event may vary considerably by location, it is important to have coverage in each place.

3-Day FRM PM2.5 – Correlation Matrix Tool – Figure 2.5, Table 2.2
The only two New Hampshire 3-day FRM sites are Nashua and Pembroke. Lebanon, Portsmouth, and Pack Monadnock are not included.

Nashua and Pembroke have a high correlation (R2=0.8706) and low average relative difference (0.1645). This would indicate that they are somewhat redundant. However, such a small sample of all FRM sites is insufficient to draw important conclusions.

6-Day FRM PM2.5 – Correlation Matrix Tool – Figure 2.6, Table 2.3
New Hampshire sites consist of: Laconia, Keene, Lebanon, Nashua, Pembroke, and Claremont. This includes all of the 1-in-6 sites listed in the NHDES 2008-09 Annual Review Plan. It also includes the 3-day FRM sites, Nashua and Pembroke, because every other sample overlaps with the 6-day schedule, allowing the datasets to be merged.

Keene and Laconia stand out as having the weakest correlation (R2=0.4468) and moderately high average relative difference (0.5046). This makes sense considering the distance between them (95 km) and the contrasting landscapes; the Keene station is located downtown in a

southwestern valley city, while the Laconia station stands in open field within the Lakes Region. For example, the populated valley of Keene experiences high levels of PM2.5 due to woodsmoke accumulation under overnight winter inversions; such inversions rarely form to that degree in the open area around Laconia.
Site pairs demonstrating the strongest similarities are Claremont/Lebanon and Pembroke/Nashua. In the first case, the sites are only 31 km apart in the same general region (near the western border of the state). Claremont has since been removed. Also, Lebanon's 1-in-6 sampling scheduled has been substituted with monthly sampling upon the addition of an FEM BAM for continuous monitoring of PM2.5. Nashua and Pembroke are slightly further apart at 41 km. Both are near urban centers, Nashua near the southern border and Pembroke outside Concord in the south-central region.

While Laconia has relatively high correlations with most other sites, except Keene and Claremont, it also has comparatively high average differences. This indicates that Laconia's concentrations are consistent in pattern with other parts of the state, but less so in degree. This follows from the fact that Laconia is within range for many regional events, and yet is far enough from the borders of the state that regional transport of PM2.5 tends to diminish before reaching it. Thus, its pattern of highs and lows tracks with sites directly to the south and west on the same typical transport paths, but the concentrations are generally lower.

In general, most site pairs exhibit a moderate to moderately-high correlation and moderate to low average relative difference. Except for the Keene/Laconia comparison described above, no site appears especially distinct. Neither is any overly repetitive in the network. The one exception to the latter may be Nashua and Pembroke, which are both part of the urban corridor in the southern part of the state; however, one is very close to the southern border, while the other covers the inland portion between Manchester and Concord. Therefore, one may conclude that the FRM network is well represented and balanced.

Figure 2.4: Continuous PM2.5 Correlation Matrix

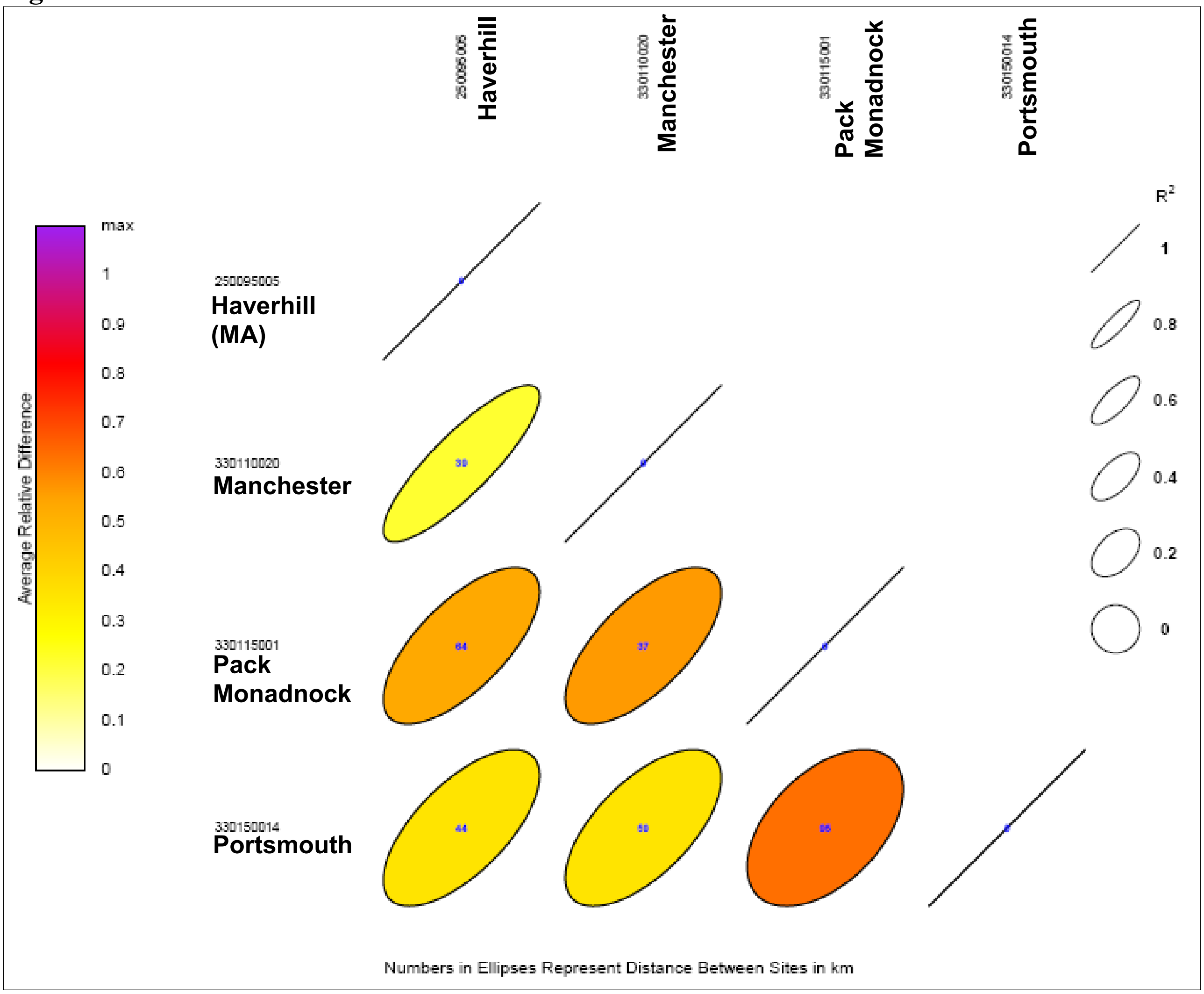


Table 2.1: Continuous PM2.5 Correlation Matrix

Site1			Site2						
Site ID#	**City**	**State**	**Site ID#**	**City**	**State**	**Distance**	**Avg Relative Difference**	**Correlation R^2**	**# Obs**
25-009-5005	Haverhill	MA	33-011-0020	Manchester	NH	39	0.2026	0.8551	1389
33-011-0020	Manchester	NH	33-011-0020	Manchester	NH	0	0	1	1390
33-011-5001	Peterborough	NH	33-011-0020	Manchester	NH	37	0.5163	0.6728	1333
33-015-0014	Portsmouth	NH	33-011-0020	Manchester	NH	59	0.3247	0.6376	1321
25-009-5005	Haverhill	MA	33-011-5001	Peterborough	NH	64	0.4869	0.6882	1374
33-011-0020	Manchester	NH	33-011-5001	Peterborough	NH	37	0.5163	0.6728	1333
33-011-5001	Peterborough	NH	33-011-5001	Peterborough	NH	0	0	1	1375
33-015-0014	Portsmouth	NH	33-011-5001	Peterborough	NH	95	0.5803	0.4948	1304
25-009-5005	Haverhill	MA	33-015-0014	Portsmouth	NH	44	0.3248	0.668	1359
33-011-0020	Manchester	NH	33-015-0014	Portsmouth	NH	59	0.3247	0.6376	1321
33-011-5001	Peterborough	NH	33-015-0014	Portsmouth	NH	95	0.5803	0.4948	1304

Site1			Site2			Distance	Avg Relative Difference	Correlation R^2	# Obs
Site ID#	City	State	Site ID#	City	State				
33-015-0014	Portsmouth	NH	33-015-0014	Portsmouth	NH	0	0	1	1360

Figure 2.5: 3-Day FRM PM2.5 Correlation Matrix

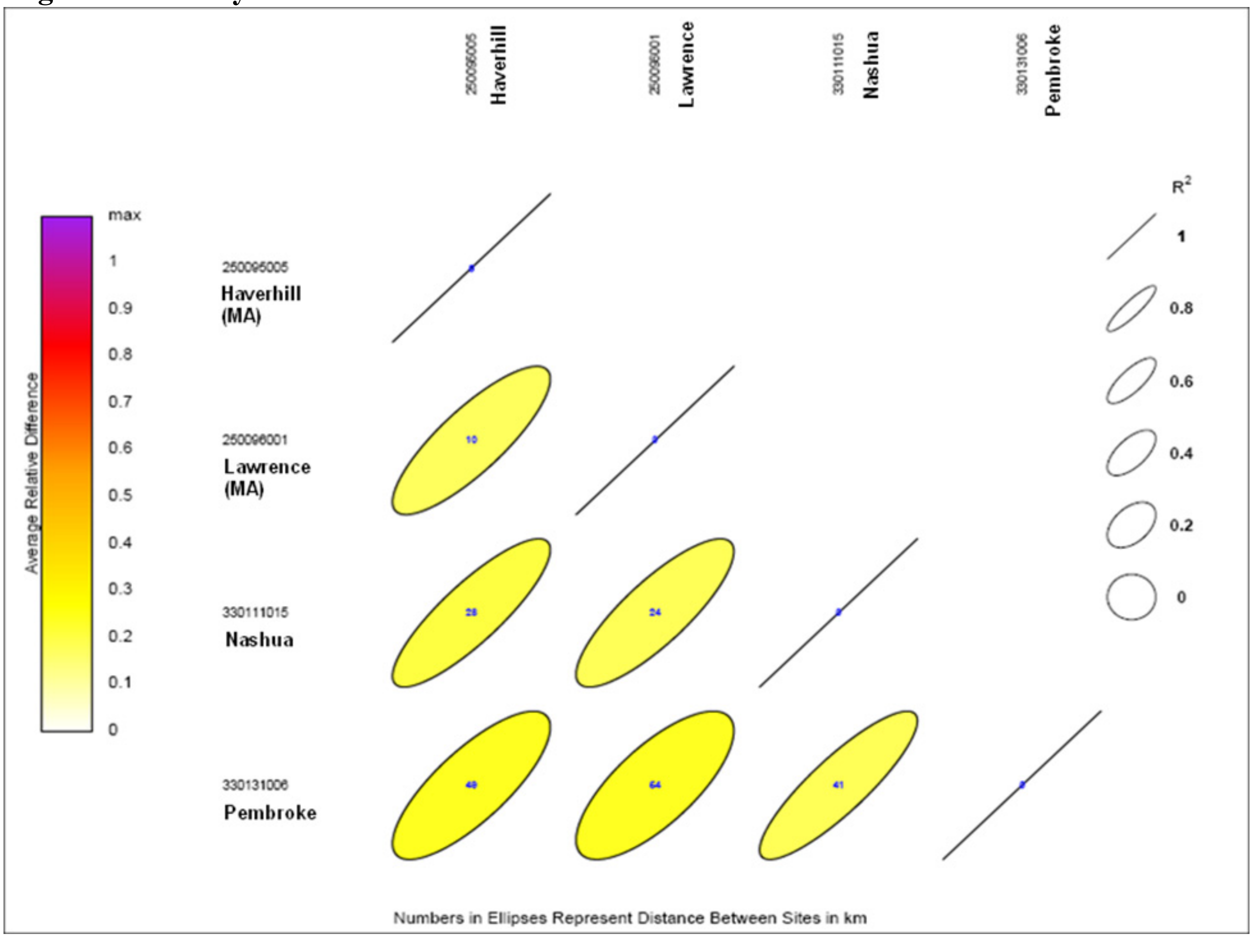


Table 2.2: 3-Day FRM PM2.5 Correlation Matrix

Site1			Site2			Distance	Avg Relative Difference	Correlation R^2	# Obs
Site ID#	City	State	Site ID#	City	State				
25-009-5005	Haverhill	MA	33-011-1015	Nashua	NH	28	0.1856	0.8529	432
25-009-6001	Lawrence	MA	33-011-1015	Nashua	NH	24	0.1636	0.8298	445
33-011-1015	Nashua	NH	33-011-1015	Nashua	NH	0	0	1	463
33-013-1006	Pembroke	NH	33-011-1015	Nashua	NH	41	0.1645	0.8706	456
25-009-5005	Haverhill	MA	33-013-1006	Pembroke	NH	49	0.2181	0.7845	450
25-009-6001	Lawrence	MA	33-013-1006	Pembroke	NH	54	0.2176	0.7375	461
33-011-1015	Nashua	NH	33-013-1006	Pembroke	NH	41	0.1645	0.8706	456
33-013-1006	Pembroke	NH	33-013-1006	Pembroke	NH	0	0	1	480
25-009-5005	Haverhill	MA	33-011-1015	Nashua	NH	28	0.1856	0.8529	432

Figure 2.6: 6-Day FRM PM2.5 Correlation Matrix

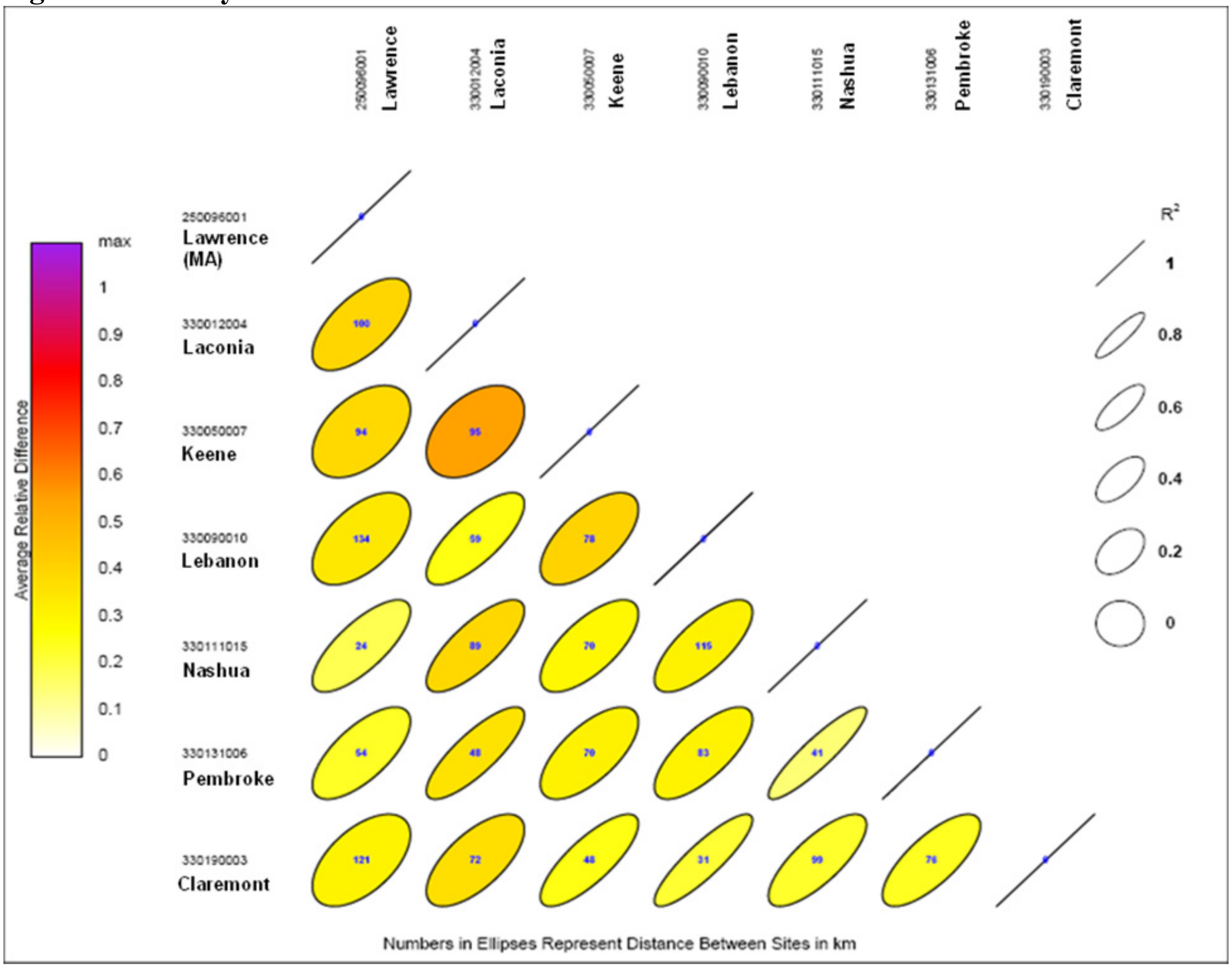


Table 2.3: 6-Day FRM PM2.5 Correlation Matrix

Site1			Site2						
Site ID#	City	State	Site ID#	City	State	Distance	Avg Relative Difference	Correlation R^2	# Obs
25-009-6001	Lawrence	MA	33-001-2004	Laconia	NH	100	0.3632	0.6398	233
33-001-2004	Laconia	NH	33-001-2004	Laconia	NH	0	0	1	241
33-005-0007	Keene	NH	33-001-2004	Laconia	NH	95	0.5046	0.4468	234
33-009-0010	Lebanon	NH	33-001-2004	Laconia	NH	59	0.2327	0.7556	229
33-011-1015	Nashua	NH	33-001-2004	Laconia	NH	89	0.3575	0.7706	232
33-013-1006	Pembroke	NH	33-001-2004	Laconia	NH	48	0.3278	0.8187	240
33-019-0003	Claremont	NH	33-001-2004	Laconia	NH	72	0.3361	0.667	231
25-009-6001	Lawrence	MA	33-005-0007	Keene	NH	94	0.3558	0.4729	228
33-001-2004	Laconia	NH	33-005-0007	Keene	NH	95	0.5046	0.4468	234
33-005-0007	Keene	NH	33-005-0007	Keene	NH	0	0	1	236
33-009-0010	Lebanon	NH	33-005-0007	Keene	NH	78	0.3702	0.6363	224
33-011-1015	Nashua	NH	33-005-0007	Keene	NH	70	0.2671	0.6921	228
33-013-1006	Pembroke	NH	33-005-0007	Keene	NH	70	0.2843	0.6725	235
33-019-0003	Claremont	NH	33-005-0007	Keene	NH	48	0.2316	0.7927	227
25-009-6001	Lawrence	MA	33-009-0010	Lebanon	NH	134	0.3123	0.5644	223
33-001-2004	Laconia	NH	33-009-0010	Lebanon	NH	59	0.2327	0.7556	229
33-005-0007	Keene	NH	33-009-0010	Lebanon	NH	78	0.3702	0.6363	224
33-009-0010	Lebanon	NH	33-009-0010	Lebanon	NH	0	0	1	231
33-011-1015	Nashua	NH	33-009-0010	Lebanon	NH	115	0.2857	0.7312	221
33-013-1006	Pembroke	NH	33-009-0010	Lebanon	NH	83	0.2818	0.7332	230
33-019-0003	Claremont	NH	33-009-0010	Lebanon	NH	31	0.1981	0.8765	223
25-009-6001	Lawrence	MA	33-011-1015	Nashua	NH	24	0.1702	0.7527	225
33-001-2004	Laconia	NH	33-011-1015	Nashua	NH	89	0.3575	0.7706	232
33-005-0007	Keene	NH	33-011-1015	Nashua	NH	70	0.2671	0.6921	228
33-009-0010	Lebanon	NH	33-011-1015	Nashua	NH	115	0.2857	0.7312	221
33-011-1015	Nashua	NH	33-011-1015	Nashua	NH	0	0	1	233
33-013-1006	Pembroke	NH	33-011-1015	Nashua	NH	41	0.1356	0.9075	232
33-019-0003	Claremont	NH	33-011-1015	Nashua	NH	99	0.2079	0.7704	224
25-009-6001	Lawrence	MA	33-013-1006	Pembroke	NH	54	0.2127	0.6897	234
33-001-2004	Laconia	NH	33-013-1006	Pembroke	NH	48	0.3278	0.8187	240
33-005-0007	Keene	NH	33-013-1006	Pembroke	NH	70	0.2843	0.6725	235
33-009-0010	Lebanon	NH	33-013-1006	Pembroke	NH	83	0.2818	0.7332	230
33-011-1015	Nashua	NH	33-013-1006	Pembroke	NH	41	0.1356	0.9075	232
33-013-1006	Pembroke	NH	33-013-1006	Pembroke	NH	0	0	1	242
33-019-0003	Claremont	NH	33-013-1006	Pembroke	NH	76	0.2162	0.7484	232
25-009-6001	Lawrence	MA	33-019-0003	Claremont	NH	121	0.2809	0.5563	225
33-001-2004	Laconia	NH	33-019-0003	Claremont	NH	72	0.3361	0.667	231
33-005-0007	Keene	NH	33-019-0003	Claremont	NH	48	0.2316	0.7927	227
33-009-0010	Lebanon	NH	33-019-0003	Claremont	NH	31	0.1981	0.8765	223
33-011-1015	Nashua	NH	33-019-0003	Claremont	NH	99	0.2079	0.7704	224
33-013-1006	Pembroke	NH	33-019-0003	Claremont	NH	76	0.2162	0.7484	232
33-019-0003	Claremont	NH	33-019-0003	Claremont	NH	0	0	1	233

Continuous Ozone – Correlation Matrix Tool – Figure 2.7, Table 2.4
New Hampshire ozone sites consist of: Laconia, Keene, Camp Dodge, Lebanon, Manchester, Nashua, Pack Monadnock, Concord, Portsmouth, Rye, and Claremont. The only site listed in the NHDES 2008-09 Annual Review Plan that is missing from this analysis is the summit of Mount Washington.

Camp Dodge, near the base of Mount Washington, has weak correlations with nearly every other site. Average relative differences, however, are not significantly high. One exception is that the average relative difference between Camp Dodge and Pack Monadnock is the greatest of all New Hampshire site pairs. The only site so far north, Camp Dodge's low correlations highlight the remote aspects of the mountainous region; it is remote from most sources, surrounded by mountains that interrupt transport, and experiences weather, such as cooler temperatures, less conducive to ozone formation than southern regions.

The coastal sites of Portsmouth and Rye are two others with mostly low correlations, including with Camp Dodge, Lebanon, Pack Monadnock, and Claremont. Notably, Pack Monadnock is a high-elevation site, and the other three are in the western and northern parts of the states, far removed from the seacoast. It follows for the unique geography of the seacoast to produce distinct results. For instance, exposure to sea breezes can produce isolated pockets of high ozone on the coast. Aside from an exceptional correlation with its neighbor Portsmouth, Rye stands out as being the most unique of all sites.

Pack Monadnock, which also stands alone in a geographic sense, has a preponderance of correlations on the low end compared to other sites, although average relative differences are not particularly high. It has its highest average relative difference with Camp Dodge and Lebanon, and its lowest correlation with Camp Dodge, followed by Rye. Pack Monadnock is subject to ozone moving into the state hundreds of meters over the surface, leading to differences in source regions or the timing of incoming ozone compared to surface sites.

Keene has the highest frequency of strong correlations and low average relative differences, not only with "nearby" sites of Claremont and Lebanon, but also with more populated areas such as Concord, Manchester, and Nashua. Ozone levels in New Hampshire are strongly tied to transport, and most summer transport channels move in from the southwest. The likeness in ozone patterns among Keene and a wide range of other cities from western to central New Hampshire fits into this context, as all will be most strongly influenced by the same presiding air flow and upwind sources.

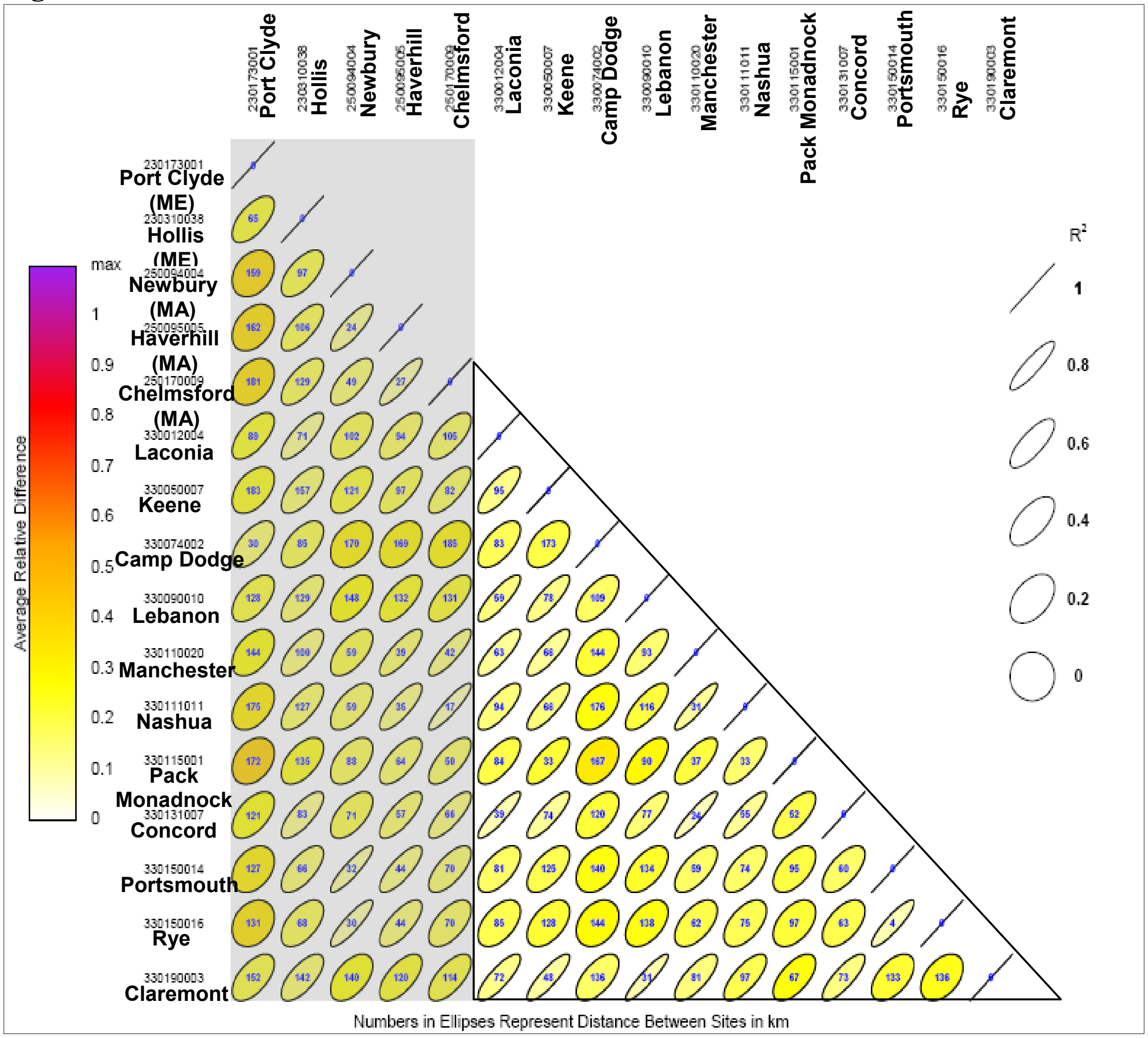
Manchester has exceptionally strong correlations with Concord (R2=0.9195) and Nashua (R2=0.9058). Since Manchester lies within 24 km of Concord to the north and 31 km of Nashua to the south, and considering again the transport nature of ozone, it is not surprising that there are parallel ozone patterns among these three sites. This does raise the question of whether it is necessary to monitor ozone at all three sites, or if only two are adequate to represent the inland region. This will be put under consideration, but currently there are no plans to remove any of these sites. Because all three lie along a major highway system and reside in densely populated urban areas, they each provide information about the production and movement of ozone along this metropolitan belt in the southern part of the state.

Another source of repetitiveness exists between Portsmouth and Rye. They are located within only 4km of each other, their relative difference is low (0.0734), and their correlation is high (R2=0.8856). Thus, it may be prudent to consider the value of two ozone sites on the coast.

Overall, average relative differences are quite low across the board, but there is a wide variation in correlation strength. The western and central sites exhibit the greatest consistency, while Camp Dodge up north, Portsmouth and Rye on the coast, and Pack Monadnock at higher elevation stand out as the most distinctive sites. These results uphold that the current ozone network is distributed in a balanced manner in which each region is represented.

The current ozone network captures transport all along the state borders via, northwest to southeast: Lebanon, Keene, Pack Monadnock, Nashua, Rye, and Portsmouth. Inland sites are strategically located along the I-93 corridor in Manchester and Concord, and Laconia represents the popular residential and recreational area in the Lakes Region of central New Hampshire. The rural north has surface coverage by Camp Dodge, while a monitor at the summit of the state's highest peak, Mount Washington, measures ozone at high elevation. The Mount Washington site is particularly important for recording late afternoon or night-time summer peaks from long-distance transport; it has also revealed surprisingly high concentrations in early Spring prior to leaf out.

Figure 2.7: Continuous Ozone Correlation Matrix



* Due to the high number of sites, New Hampshire sites have been distinguished by a triangular border and out-of-state sites shaded in light gray.

Table 2.4: Continuous Ozone Correlation Matrix

Site1			Site2						
Site ID#	City	State	Site ID#	City	State	Distance	Avg Relative Difference	Correlation R^2	# Obs
23-017-3001	Port Clyde	ME	33-001-2004	Laconia	NH	89	0.2206	0.6507	611
23-031-0038	Hollis	ME	33-001-2004	Laconia	NH	71	0.1085	0.7973	606
25-009-4004	Newbury	MA	33-001-2004	Laconia	NH	102	0.1817	0.5636	609
25-009-5005	Haverhill	MA	33-001-2004	Laconia	NH	94	0.165	0.6978	612
25-017-0009	Chelmsford	MA	33-001-2004	Laconia	NH	105	0.161	0.6794	592
33-001-2004	Laconia	NH	33-001-2004	Laconia	NH	0	0	1	612
33-005-0007	Keene	NH	33-001-2004	Laconia	NH	95	0.1163	0.7839	612
33-007-4002	Camp Dodge	NH	33-001-2004	Laconia	NH	83	0.1654	0.6292	606
33-009-0010	Lebanon	NH	33-001-2004	Laconia	NH	59	0.1274	0.8455	612
33-011-0020	Manchester	NH	33-001-2004	Laconia	NH	63	0.1009	0.8203	612
33-011-1011	Nashua	NH	33-001-2004	Laconia	NH	94	0.1304	0.7591	608

Site1			Site2						
Site ID#	**City**	**State**	**Site ID#**	**City**	**State**	**Distance**	**Avg Relative Difference**	**Correlation R^2**	**# Obs**
33-011-5001	Peterborough	NH	33-001-2004	Laconia	NH	84	0.182	0.6656	612
33-013-1007	Concord	NH	33-001-2004	Laconia	NH	39	0.0763	0.8968	607
33-015-0014	Portsmouth	NH	33-001-2004	Laconia	NH	81	0.1511	0.6061	612
33-015-0016	Rye	NH	33-001-2004	Laconia	NH	85	0.174	0.5203	607
33-019-0003	Claremont	NH	33-001-2004	Laconia	NH	72	0.1156	0.8161	612
23-017-3001	Port Clyde	ME	33-005-0007	Keene	NH	183	0.2279	0.4728	611
23-031-0038	Hollis	ME	33-005-0007	Keene	NH	157	0.1412	0.6693	606
25-009-4004	Newbury	MA	33-005-0007	Keene	NH	121	0.207	0.5745	609
25-009-5005	Haverhill	MA	33-005-0007	Keene	NH	97	0.179	0.7217	612
25-017-0009	Chelmsford	MA	33-005-0007	Keene	NH	82	0.1615	0.75	592
33-001-2004	Laconia	NH	33-005-0007	Keene	NH	95	0.1163	0.7839	612
33-005-0007	Keene	NH	33-005-0007	Keene	NH	0	0	1	612
33-007-4002	Camp Dodge	NH	33-005-0007	Keene	NH	173	0.1831	0.5076	606
33-009-0010	Lebanon	NH	33-005-0007	Keene	NH	78	0.1163	0.8259	612
33-011-0020	Manchester	NH	33-005-0007	Keene	NH	66	0.1004	0.8298	612
33-011-1011	Nashua	NH	33-005-0007	Keene	NH	66	0.132	0.8201	608
33-011-5001	Peterborough	NH	33-005-0007	Keene	NH	33	0.1985	0.7425	612
33-013-1007	Concord	NH	33-005-0007	Keene	NH	74	0.0989	0.8439	607
33-015-0014	Portsmouth	NH	33-005-0007	Keene	NH	125	0.172	0.6058	612
33-015-0016	Rye	NH	33-005-0007	Keene	NH	128	0.1988	0.507	607
33-019-0003	Claremont	NH	33-005-0007	Keene	NH	48	0.0935	0.8556	612
23-017-3001	Port Clyde	ME	33-007-4002	Camp Dodge	NH	30	0.145	0.629	605
23-031-0038	Hollis	ME	33-007-4002	Camp Dodge	NH	85	0.1786	0.573	600
25-009-4004	Newbury	MA	33-007-4002	Camp Dodge	NH	170	0.2805	0.3546	603
25-009-5005	Haverhill	MA	33-007-4002	Camp Dodge	NH	169	0.2757	0.4161	606
25-017-0009	Chelmsford	MA	33-007-4002	Camp Dodge	NH	185	0.2692	0.3998	587
33-001-2004	Laconia	NH	33-007-4002	Camp Dodge	NH	83	0.1654	0.6292	606
33-005-0007	Keene	NH	33-007-4002	Camp Dodge	NH	173	0.1831	0.5076	606
33-007-4002	Camp Dodge	NH	33-007-4002	Camp Dodge	NH	0	0	1	606
33-009-0010	Lebanon	NH	33-007-4002	Camp Dodge	NH	109	0.1532	0.6247	606
33-011-0020	Manchester	NH	33-007-4002	Camp Dodge	NH	144	0.1999	0.465	606
33-011-1011	Nashua	NH	33-007-4002	Camp Dodge	NH	176	0.2445	0.4477	602
33-011-5001	Peterborough	NH	33-007-4002	Camp Dodge	NH	167	0.3083	0.3658	606
33-013-1007	Concord	NH	33-007-4002	Camp Dodge	NH	120	0.195	0.5403	601
33-015-0014	Portsmouth	NH	33-007-4002	Camp Dodge	NH	140	0.2379	0.381	606
33-015-0016	Rye	NH	33-007-4002	Camp Dodge	NH	144	0.2601	0.315	601
33-019-0003	Claremont	NH	33-007-4002	Camp Dodge	NH	136	0.1501	0.6087	606
23-017-3001	Port Clyde	ME	33-009-0010	Lebanon	NH	128	0.1977	0.5686	611
23-031-0038	Hollis	ME	33-009-0010	Lebanon	NH	129	0.1499	0.7114	606
25-009-4004	Newbury	MA	33-009-0010	Lebanon	NH	148	0.2543	0.5355	609
25-009-5005	Haverhill	MA	33-009-0010	Lebanon	NH	132	0.2323	0.6609	612
25-017-0009	Chelmsford	MA	33-009-0010	Lebanon	NH	131	0.2158	0.6615	592
33-001-2004	Laconia	NH	33-009-0010	Lebanon	NH	59	0.1274	0.8455	612
33-005-0007	Keene	NH	33-009-0010	Lebanon	NH	78	0.1163	0.8259	612
33-007-4002	Camp Dodge	NH	33-009-0010	Lebanon	NH	109	0.1532	0.6247	606

Site1			Site2						
Site ID#	**City**	**State**	**Site ID#**	**City**	**State**	**Distance**	**Avg Relative Difference**	**Correlation R^2**	**# Obs**
33-009-0010	Lebanon	NH	33-009-0010	Lebanon	NH	0	0	1	612
33-011-0020	Manchester	NH	33-009-0010	Lebanon	NH	93	0.1414	0.755	612
33-011-1011	Nashua	NH	33-009-0010	Lebanon	NH	116	0.1901	0.7385	608
33-011-5001	Peterborough	NH	33-009-0010	Lebanon	NH	90	0.263	0.6386	612
33-013-1007	Concord	NH	33-009-0010	Lebanon	NH	77	0.1342	0.8179	607
33-015-0014	Portsmouth	NH	33-009-0010	Lebanon	NH	134	0.2086	0.5754	612
33-015-0016	Rye	NH	33-009-0010	Lebanon	NH	138	0.2366	0.4809	607
33-019-0003	Claremont	NH	33-009-0010	Lebanon	NH	31	0.079	0.9187	612
23-017-3001	Port Clyde	ME	33-011-0020	Manchester	NH	144	0.2408	0.4649	611
23-031-0038	Hollis	ME	33-011-0020	Manchester	NH	100	0.13	0.7088	606
25-009-4004	Newbury	MA	33-011-0020	Manchester	NH	59	0.1877	0.6179	609
25-009-5005	Haverhill	MA	33-011-0020	Manchester	NH	39	0.15	0.8101	612
25-017-0009	Chelmsford	MA	33-011-0020	Manchester	NH	42	0.1271	0.8467	592
33-001-2004	Laconia	NH	33-011-0020	Manchester	NH	63	0.1009	0.8203	612
33-005-0007	Keene	NH	33-011-0020	Manchester	NH	66	0.1004	0.8298	612
33-007-4002	Camp Dodge	NH	33-011-0020	Manchester	NH	144	0.1999	0.465	606
33-009-0010	Lebanon	NH	33-011-0020	Manchester	NH	93	0.1414	0.755	612
33-011-0020	Manchester	NH	33-011-0020	Manchester	NH	0	0	1	612
33-011-1011	Nashua	NH	33-011-0020	Manchester	NH	31	0.0991	0.9058	608
33-011-5001	Peterborough	NH	33-011-0020	Manchester	NH	37	0.1879	0.722	612
33-013-1007	Concord	NH	33-011-0020	Manchester	NH	24	0.0657	0.9195	607
33-015-0014	Portsmouth	NH	33-011-0020	Manchester	NH	59	0.1505	0.6566	612
33-015-0016	Rye	NH	33-011-0020	Manchester	NH	62	0.1777	0.5585	607
33-019-0003	Claremont	NH	33-011-0020	Manchester	NH	81	0.1277	0.7539	612
23-017-3001	Port Clyde	ME	33-011-1011	Nashua	NH	175	0.2996	0.42	607
23-031-0038	Hollis	ME	33-011-1011	Nashua	NH	127	0.1514	0.6971	602
25-009-4004	Newbury	MA	33-011-1011	Nashua	NH	59	0.1597	0.6221	605
25-009-5005	Haverhill	MA	33-011-1011	Nashua	NH	35	0.1191	0.7975	608
25-017-0009	Chelmsford	MA	33-011-1011	Nashua	NH	17	0.0759	0.9017	589
33-001-2004	Laconia	NH	33-011-1011	Nashua	NH	94	0.1304	0.7591	608
33-005-0007	Keene	NH	33-011-1011	Nashua	NH	66	0.132	0.8201	608
33-007-4002	Camp Dodge	NH	33-011-1011	Nashua	NH	176	0.2445	0.4477	602
33-009-0010	Lebanon	NH	33-011-1011	Nashua	NH	116	0.1901	0.7385	608
33-011-0020	Manchester	NH	33-011-1011	Nashua	NH	31	0.0991	0.9058	608
33-011-1011	Nashua	NH	33-011-1011	Nashua	NH	0	0	1	608
33-011-5001	Peterborough	NH	33-011-1011	Nashua	NH	33	0.1424	0.7275	608
33-013-1007	Concord	NH	33-011-1011	Nashua	NH	55	0.1021	0.8653	603
33-015-0014	Portsmouth	NH	33-011-1011	Nashua	NH	74	0.1476	0.6496	608
33-015-0016	Rye	NH	33-011-1011	Nashua	NH	75	0.1689	0.5526	603
33-019-0003	Claremont	NH	33-011-1011	Nashua	NH	97	0.1697	0.7365	608
23-017-3001	Port Clyde	ME	33-011-5001	Peterborough	NH	172	0.3749	0.3263	611
23-031-0038	Hollis	ME	33-011-5001	Peterborough	NH	135	0.2266	0.5537	606
25-009-4004	Newbury	MA	33-011-5001	Peterborough	NH	88	0.1684	0.5309	609
25-009-5005	Haverhill	MA	33-011-5001	Peterborough	NH	64	0.1512	0.6761	612
25-017-0009	Chelmsford	MA	33-011-5001	Peterborough	NH	50	0.1559	0.695	592

Site1			Site2						
Site ID#	City	State	Site ID#	City	State	Distance	Avg Relative Difference	Correlation R^2	# Obs
33-001-2004	Laconia	NH	33-011-5001	Peterborough	NH	84	0.182	0.6656	612
33-005-0007	Keene	NH	33-011-5001	Peterborough	NH	33	0.1985	0.7425	612
33-007-4002	Camp Dodge	NH	33-011-5001	Peterborough	NH	167	0.3083	0.3658	606
33-009-0010	Lebanon	NH	33-011-5001	Peterborough	NH	90	0.263	0.6386	612
33-011-0020	Manchester	NH	33-011-5001	Peterborough	NH	37	0.1879	0.722	612
33-011-1011	Nashua	NH	33-011-5001	Peterborough	NH	33	0.1424	0.7275	608
33-011-5001	Peterborough	NH	33-011-5001	Peterborough	NH	0	0	1	612
33-013-1007	Concord	NH	33-011-5001	Peterborough	NH	52	0.1773	0.7043	607
33-015-0014	Portsmouth	NH	33-011-5001	Peterborough	NH	95	0.1869	0.5531	612
33-015-0016	Rye	NH	33-011-5001	Peterborough	NH	97	0.1974	0.4767	607
33-019-0003	Claremont	NH	33-011-5001	Peterborough	NH	67	0.2425	0.619	612
23-017-3001	Port Clyde	ME	33-013-1007	Concord	NH	121	0.2388	0.548	606
23-031-0038	Hollis	ME	33-013-1007	Concord	NH	83	0.1148	0.7679	601
25-009-4004	Newbury	MA	33-013-1007	Concord	NH	71	0.1819	0.5988	604
25-009-5005	Haverhill	MA	33-013-1007	Concord	NH	57	0.1504	0.7637	607
25-017-0009	Chelmsford	MA	33-013-1007	Concord	NH	66	0.1313	0.7956	587
33-001-2004	Laconia	NH	33-013-1007	Concord	NH	39	0.0763	0.8968	607
33-005-0007	Keene	NH	33-013-1007	Concord	NH	74	0.0989	0.8439	607
33-007-4002	Camp Dodge	NH	33-013-1007	Concord	NH	120	0.195	0.5403	601
33-009-0010	Lebanon	NH	33-013-1007	Concord	NH	77	0.1342	0.8179	607
33-011-0020	Manchester	NH	33-013-1007	Concord	NH	24	0.0657	0.9195	607
33-011-1011	Nashua	NH	33-013-1007	Concord	NH	55	0.1021	0.8653	603
33-011-5001	Peterborough	NH	33-013-1007	Concord	NH	52	0.1773	0.7043	607
33-013-1007	Concord	NH	33-013-1007	Concord	NH	0	0	1	607
33-015-0014	Portsmouth	NH	33-013-1007	Concord	NH	60	0.1488	0.6433	607
33-015-0016	Rye	NH	33-013-1007	Concord	NH	63	0.1768	0.54	602
33-019-0003	Claremont	NH	33-013-1007	Concord	NH	73	0.1192	0.8106	607
23-017-3001	Port Clyde	ME	33-015-0014	Portsmouth	NH	127	0.289	0.348	611
23-031-0038	Hollis	ME	33-015-0014	Portsmouth	NH	66	0.1422	0.6777	606
25-009-4004	Newbury	MA	33-015-0014	Portsmouth	NH	32	0.0923	0.8969	609
25-009-5005	Haverhill	MA	33-015-0014	Portsmouth	NH	44	0.126	0.7913	612
25-017-0009	Chelmsford	MA	33-015-0014	Portsmouth	NH	70	0.1459	0.6823	592
33-001-2004	Laconia	NH	33-015-0014	Portsmouth	NH	81	0.1511	0.6061	612
33-005-0007	Keene	NH	33-015-0014	Portsmouth	NH	125	0.172	0.6058	612
33-007-4002	Camp Dodge	NH	33-015-0014	Portsmouth	NH	140	0.2379	0.381	606
33-009-0010	Lebanon	NH	33-015-0014	Portsmouth	NH	134	0.2086	0.5754	612
33-011-0020	Manchester	NH	33-015-0014	Portsmouth	NH	59	0.1505	0.6566	612
33-011-1011	Nashua	NH	33-015-0014	Portsmouth	NH	74	0.1476	0.6496	608
33-011-5001	Peterborough	NH	33-015-0014	Portsmouth	NH	95	0.1869	0.5531	612
33-013-1007	Concord	NH	33-015-0014	Portsmouth	NH	60	0.1488	0.6433	607
33-015-0014	Portsmouth	NH	33-015-0014	Portsmouth	NH	0	0	1	612
33-015-0016	Rye	NH	33-015-0014	Portsmouth	NH	4	0.0734	0.8856	607
33-019-0003	Claremont	NH	33-015-0014	Portsmouth	NH	133	0.1996	0.5393	612
23-017-3001	Port Clyde	ME	33-015-0016	Rye	NH	131	0.3155	0.2646	606
23-031-0038	Hollis	ME	33-015-0016	Rye	NH	68	0.1731	0.557	601

Site1			Site2						
Site ID#	City	State	Site ID#	City	State	Distance	Avg Relative Difference	Correlation R^2	# Obs
25-009-4004	Newbury	MA	33-015-0016	Rye	NH	30	0.0859	0.8785	604
25-009-5005	Haverhill	MA	33-015-0016	Rye	NH	44	0.1376	0.7223	607
25-017-0009	Chelmsford	MA	33-015-0016	Rye	NH	70	0.1643	0.5939	587
33-001-2004	Laconia	NH	33-015-0016	Rye	NH	85	0.174	0.5203	607
33-005-0007	Keene	NH	33-015-0016	Rye	NH	128	0.1988	0.507	607
33-007-4002	Camp Dodge	NH	33-015-0016	Rye	NH	144	0.2601	0.315	601
33-009-0010	Lebanon	NH	33-015-0016	Rye	NH	138	0.2366	0.4809	607
33-011-0020	Manchester	NH	33-015-0016	Rye	NH	62	0.1777	0.5585	607
33-011-1011	Nashua	NH	33-015-0016	Rye	NH	75	0.1689	0.5526	603
33-011-5001	Peterborough	NH	33-015-0016	Rye	NH	97	0.1974	0.4767	607
33-013-1007	Concord	NH	33-015-0016	Rye	NH	63	0.1768	0.54	602
33-015-0014	Portsmouth	NH	33-015-0016	Rye	NH	4	0.0734	0.8856	607
33-015-0016	Rye	NH	33-015-0016	Rye	NH	0	0	1	607
33-019-0003	Claremont	NH	33-015-0016	Rye	NH	136	0.2268	0.4415	607
23-017-3001	Port Clyde	ME	33-019-0003	Claremont	NH	152	0.1918	0.5866	611
23-031-0038	Hollis	ME	33-019-0003	Claremont	NH	142	0.1465	0.6895	606
25-009-4004	Newbury	MA	33-019-0003	Claremont	NH	140	0.2373	0.5134	609
25-009-5005	Haverhill	MA	33-019-0003	Claremont	NH	120	0.2169	0.6408	612
25-017-0009	Chelmsford	MA	33-019-0003	Claremont	NH	114	0.1979	0.6596	592
33-001-2004	Laconia	NH	33-019-0003	Claremont	NH	72	0.1156	0.8161	612
33-005-0007	Keene	NH	33-019-0003	Claremont	NH	48	0.0935	0.8556	612
33-007-4002	Camp Dodge	NH	33-019-0003	Claremont	NH	136	0.1501	0.6087	606
33-009-0010	Lebanon	NH	33-019-0003	Claremont	NH	31	0.079	0.9187	612
33-011-0020	Manchester	NH	33-019-0003	Claremont	NH	81	0.1277	0.7539	612
33-011-1011	Nashua	NH	33-019-0003	Claremont	NH	97	0.1697	0.7365	608
33-011-5001	Peterborough	NH	33-019-0003	Claremont	NH	67	0.2425	0.619	612
33-013-1007	Concord	NH	33-019-0003	Claremont	NH	73	0.1192	0.8106	607
33-015-0014	Portsmouth	NH	33-019-0003	Claremont	NH	133	0.1996	0.5393	612
33-015-0016	Rye	NH	33-019-0003	Claremont	NH	136	0.2268	0.4415	607
33-019-0003	Claremont	NH	33-019-0003	Claremont	NH	0	0	1	612

Area Served Tool

DES ran the area served tool for the following parameters:

- Continuous PM2.5 – all sites
- Continuous PM2.5 – surface sites only (excluding high elevation sites)
- FRM PM2.5
- Continuous Ozone – all sites
- Continuous Ozone – surface sites only (excluding high elevation sites)

This tool allows the user to provide lists of sites to be included. These lists were composed based on the current network. The output of this tool comes in a graphic and tabular format.

The graphic output is a Google Earth map illustrating the area covered by each site. The population estimates (table only) describe which sites represent more populated or rural regions. The square mileage of each tract can be used to determine whether any particular site represents an overly broad or narrow area. Combining these statistics can be useful in evaluating whether some areas are more densely covered than necessary or whether additional sites may help to divide these areas into more balanced segments.

Continuous PM2.5 – Area Served Tool – Figures 2.8, 2.9 and Tables 2.5, 2.6
Since Pack Monadnock is distinct as a high-elevation site with intermittent population exposure, it was removed from a second trial by this tool to better assess representation of populated areas. Without Pack Monadnock, the PM2.5 sites are distributed fairly evenly throughout southern New Hampshire, which becomes divided into four regions: Southwest (Keene); Northwest (Lebanon); Central (Manchester); and East/Coast (Portsmouth).

By population, Manchester by far represents both the greatest square mileage as well as total population. Portsmouth is next in terms of population (yet still half of Manchester), but it covers a comparatively small area. It is appropriate for Portsmouth to represent a narrow region, since it is most characteristic of the unique environment closest to the coast. This includes the sea breeze affect which draws in a fetch from the ocean and, with it, any pollution that has built up off the coast from upwind sources, such as the city of Boston.

In the western regions, where population density is much smaller, it may be adequate for one site to represent a large area, as long as there is limited topographic variation. Note that Keene is in a steep valley that may not characterize the majority of its region; nevertheless, as mentioned previously, Keene's valley aspect makes it indispensible for capturing winter-time inversion events that create localized build up of smoke from wood-burning devices. It is also located in the heart of the most densely populated town in that county.

Manchester, while centrally located, is the site with the greatest representative burden. Depending on whether air quality can be expected to be uniform throughout, these results suggest that it may be beneficial to divide the central region into two halfs to more evenly apportion the coverage. Referring back to the correlation matrix results reveals that Pembroke, which lies just north of Manchester, and Nashua, which lies directly to the south, both agree well based on FRM data. From 3-day FRM samples, the relative difference and correlation for these two cities were 0.1645 and 0.8706, respectively. Given that these extremities along the highway route are in such close agreement, monitoring in the city of Manchester, which lies between them, can be expected to approximate the PM2.5 levels for the whole area in most cases.

Finally, there is no representation near or north of the Lakes Region. While populations and PM2.5 levels may be low in the far north, many people live along the lakes and tourists from in and out of state frequent this area during the summer months. Therefore, there may be reason to consider additional monitoring near the Lakes. Laconia in the Lakes Region is, however, a 6-day FRM site. Again recalling the correlation matrix results, they indicate that Laconia has a very low correlation and high relative difference with Keene in the southwestern region. It also has moderately low correlations and high relative differences with both Nashua and Pembroke. This suggests that the Lakes Region is indeed distinct in its PM2.5 patterns from those locations further south, and that it may be beneficial to consider more intensive continuous monitoring at Laconia as resources allow.

Figure 2.8: Continuous PM2.5 Area Served – all sites

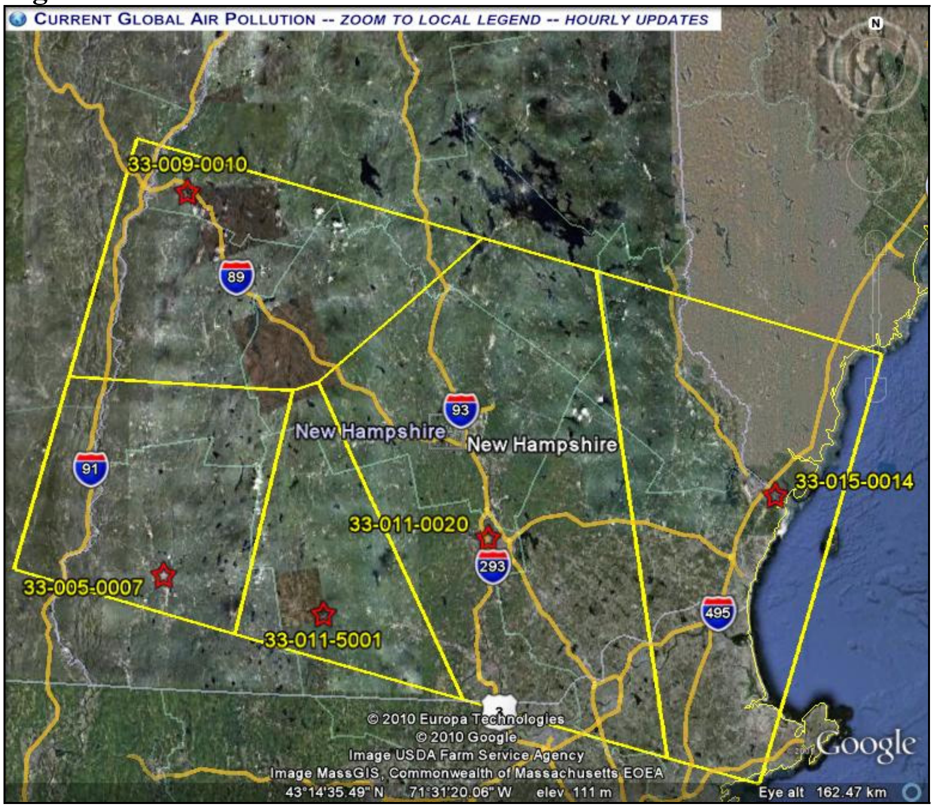


Figure 2.9: Continuous PM2.5 Area Served – surface sites only (excluding Pack Monadnock)

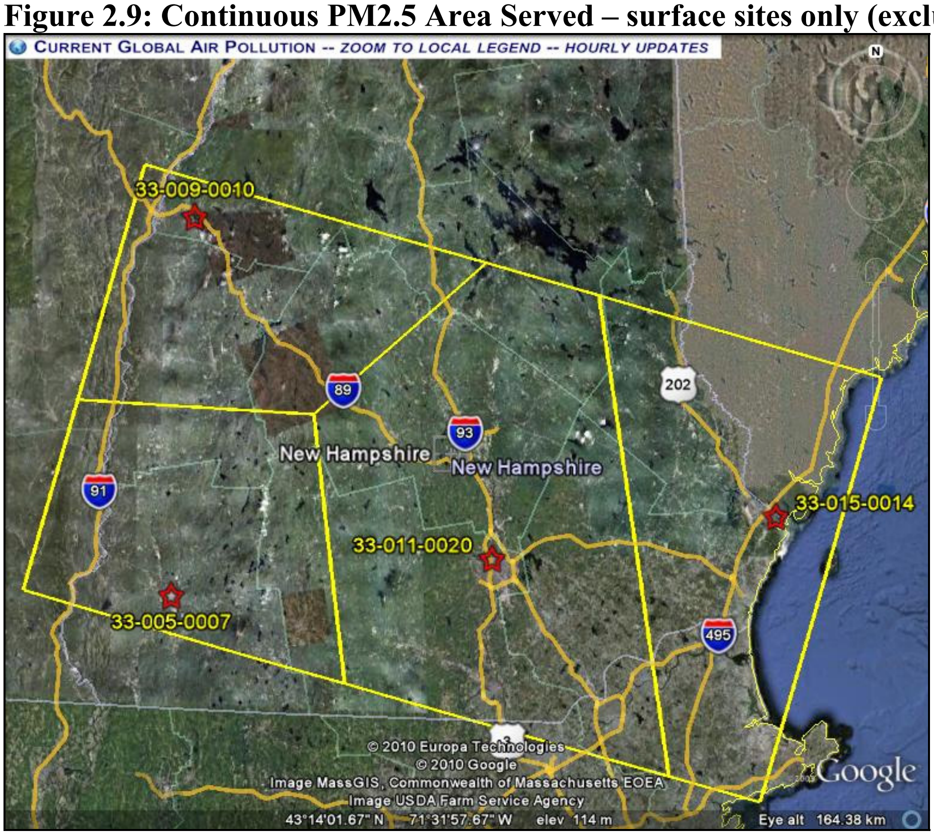


Table 2.5: Continuous PM2.5 Area Served – all sites

Site ID	Address	City	Total Population (2000)	Total Population (2008)	Tract Area (sqmi)	Population Density (2000)	Population Density (2008)
33-015-0014	Peirce Island	Portsmouth	445,035	470,586	1,251	356	376
33-011-0020	Pearl Street	Manchester	892,653	938,987	1,787	499	525
33-011-5001	Pack Monadnock	Peterborough	65,128	68,697	521	125	132
33-009-0010	Lebanon Airport	Lebanon	95,435	100,190	992	96	101
33-005-0007	Water Street	Keene	73,192	75,374	859	85	88

Table 2.6: Continuous PM2.5 Area Served – surface sites only (excluding Pack Monadnock)

Site ID	Address	City	Total Population (2000)	Total Population (2008)	Tract Area (sqmi)	Population Density (2000)	Population Density (2008)
33-015-0014	Peirce Island	Portsmouth	445,035	470,586	1,251	356	376
33-011-0020	Pearl Street	Manchester	929,502	977,887	2,012	462	486
33-009-0010	Lebanon Airport	Lebanon	95,435	100,190	992	96	101
33-005-0007	Water Street	Keene	101,471	105,171	1,155	88	91

FRM PM2.5 – Area Served Tool – Figure 2.10, Table 2.7

The distribution of FRM sites breaks southern New Hampshire into five regions: Southwest (Keene); North (Laconia); Central (Pembroke); South (Nashua); and East/Coast (Portsmouth).

The areas are more evenly divided by square mileage than the continuous PM2.5 monitoring sites. Nashua represents the most densely populated section, with the smallest area and greatest population. The Nashua region accounts for almost twice as many people as the Portsmouth region; however, this is inflated because the tract overlaps significantly with northeastern Massachusetts. Pembroke represents the largest area, but the third highest population. Regions represented by Laconia, followed by Keene, have the lowest populations despite square mileage comparable to the other regions.

The only under-represented area by the FRMs is the northwestern section. It is merged into the southwestern and northern tracts. However, it is now covered by a continuous federal equivalent method (BAM) in Lebanon. Incorporating this into the diagram would create a well-balanced and complete FRM/FEM network.

Figure 2.10: FRM PM2.5 Area Served

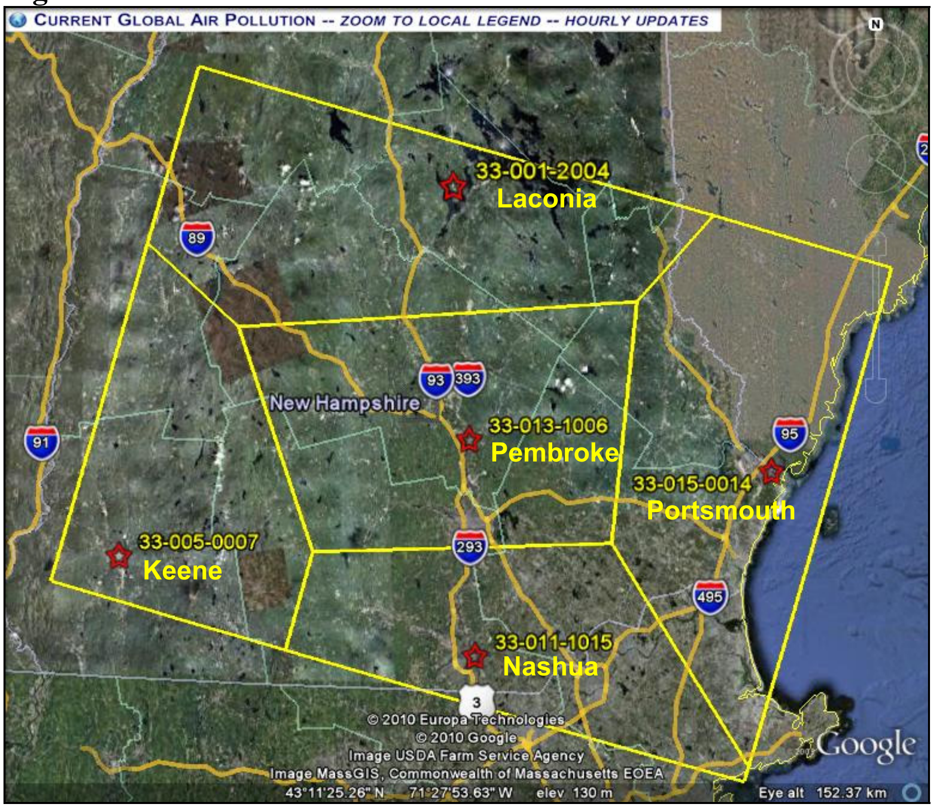


Table 2.7: FRM PM2.5 Area Served

Site ID	Address	City	Total Population (2000)	Total Population (2008)	Tract Area (sqmi)	Population Density (2000)	Population Density (2008)
33-015-0014	Pierce Island	Portsmouth	378,184	403,377	999	379	404
33-011-1015	Crown Street	Nashua	732,776	760,670	857	855	888
33-013-1006	Pleasant Street	Pembroke	301,387	322,713	1,301	232	248
33-001-2004	Green Street	Laconia	104,167	112,525	1,188	88	95
33-005-0007	Water Street	Keene	82,678	86,749	911	91	95

Ozone – Area Served Tool – Figures 2.10, 2.11 and Tables 2.8, 2.9

As done in the case of continuous PM2.5, the initial ozone analysis was redone to exclude the high elevation sites. This isolates the monitors relevant for a population-based assessment.

Excluding high elevations, the ozone sites divide New Hampshire into several regions: North (Camp Dodge); Lakes Region (Laconia); Northwest (Lebanon); Southwest (Keene); Central-North (Concord); Central (Manchester); Central-South (Nashua); East/Coast-North (Portsmouth); and East/Coast-South (Rye).

Camp Dodge represents the largest area, but this rural region has a very small population density. The coastal site Rye represents the smallest area, but it has the second highest population density and a unique geography subject to temperature moderated by the ocean and potentially polluting sea breezes. Sites along I-93 provide dense coverage of this highly urbanized region by breaking it into three relatively small segments. Overall, the square mileage is very well balanced.

In terms of total population, Nashua stands out with a population almost three times the next most populated region around Portsmouth. However, these numbers must be tempered by the overlap of this tract into the greater Boston area of Massachusetts. In reality, this area would probably match much more closely with nearby tracts if only New Hampshire populations were included. Similarly, the Portsmouth tract must be considered a vast overestimate, since its tract extends up the populated Maine coast. The Camp Dodge area also encompasses a large portion of Maine, although the additions are more rural.

When discounting the inflated populations of the Nashua and Portsmouth regions, Manchester (likely competing with Nashua) has the highest total population. However, overall, each region is remarkably similar in population distribution. For instance, unlike the PM2.5 network, the highly-populated central region is divided into three narrow segments. Moreover, monitors are also provided for the Lakes Region and the northern region (minus the far north). This network coordinates monitoring locations and population density such that each monitor represents a similar population base.

Figure 2.11: Ozone Area Served – all sites

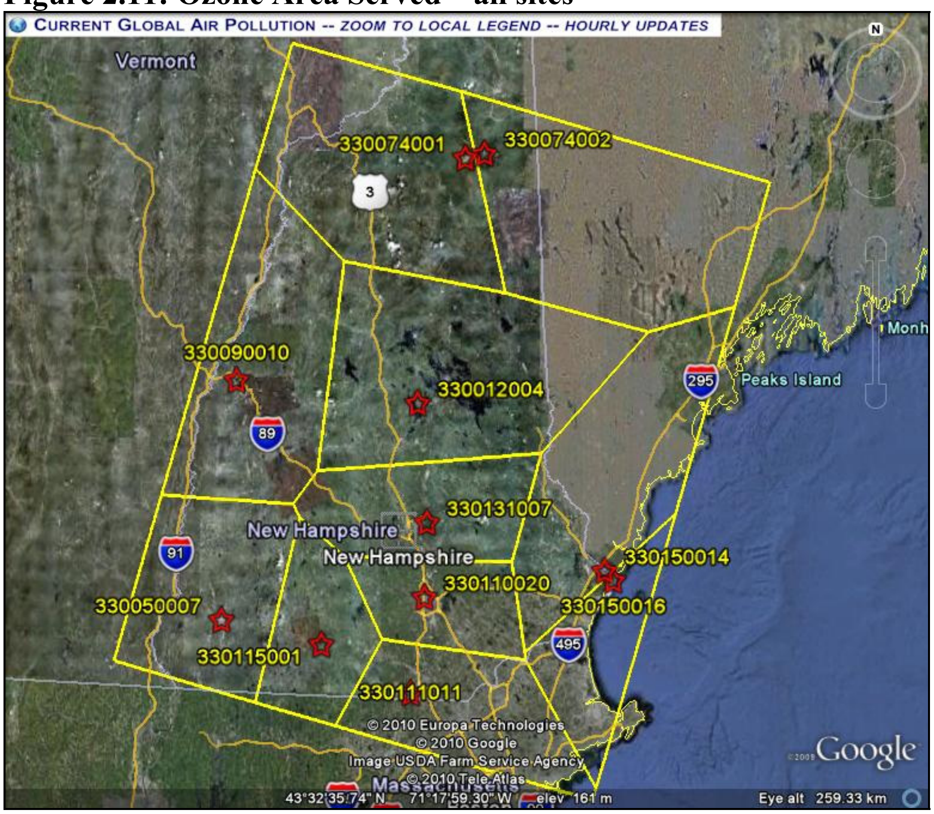


Figure 2.12: Ozone Area Served – surface sites only (excluding Pack Monadnock and Mt. Washington)

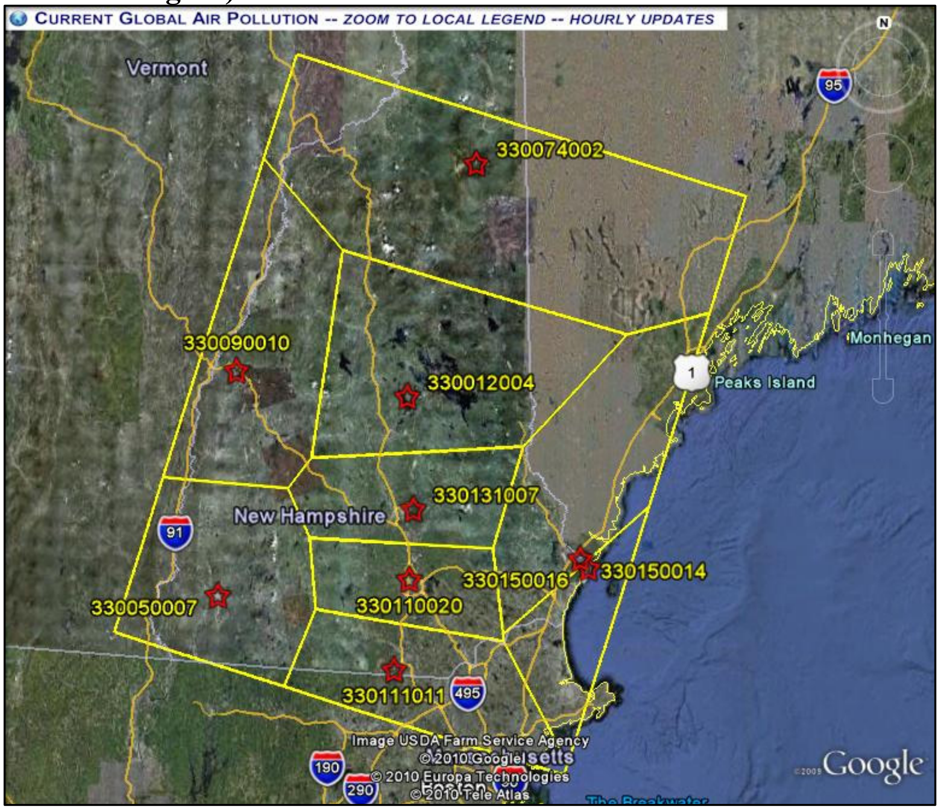


Table 2.8: Ozone Area Served – all sites

Site ID	Address	City	Total Population (2000)	Total Population (2008)	Tract Area (sqmi)	Population Density (2000)	Population Density (2008)
33-015-0016	Odiorne State Park	Rye	174,254	179,246	299	583	600
33-015-0014	Peirce Island	Portsmouth	444,739	476,311	1,330	334	358
33-007-4002	Camp Dodge		176,109	182,510	1,981	89	92
33-007-4001	Mt. Washington		48,189	49,567	1,549	31	32
33-013-1007	Hazen Drive	Concord	118,361	128,547	775	153	166
33-011-0020	Pearl Street	Manchester	291,892	310,333	576	506	538
33-001-2004	Green Street	Laconia	140,588	152,088	1,896	74	80
33-011-1011	Gilson Road	Nashua	1,233,436	1,261,723	898	1,373	1,405
33-011-5001	Pack Monadnock	Peterborough	68,083	71,476	614	111	116
33-009-0010	Lebanon Airport	Lebanon	112,725	117,403	1,577	72	74
33-005-0007	Water Street	Keene	103,441	106,168	1,089	95	97

Table 2.9: Ozone Area Served – surface sites only (excluding Pack Monadnock and Mt. Washington)

Site ID	Address	City	Total Population (2000)	Total Population (2008)	Tract Area (sqmi)	Population Density (2000)	Population Density (2008)
33-015-0016	Odiorne State Park	Rye	174,254	179,246	299	583	600
33-015-0014	Peirce Island	Portsmouth	444,739	476,311	1,330	334	358
33-007-4002	Camp Dodge		224,298	232,077	3,530	64	66
33-013-1007	Hazen Drive	Concord	118,361	128,547	775	153	166
33-011-0020	Pearl Street	Manchester	300,267	319,174	697	431	458
33-001-2004	Green Street	Laconia	140,588	152,088	1,896	74	80
33-011-1011	Gilson Road	Nashua	1,257,585	1,287,025	1,096	1,148	1,175
33-009-0010	Lebanon Airport	Lebanon	112,725	117,403	1,577	72	74
33-005-0007	Water Street	Keene	139,000	143,501	1,384	100	104

New Sites Tool

The New Sites tool checks each monitor against certain criteria to find gaps in the network where additional monitoring could be considered. The criteria are:

- Whether surrounding site pairs are more than a certain distance apart (default = 100 km)
- Whether surrounding site pairs have a correlation factor lower than a certain value (default = R^2 of 0.5)
- Whether surrounding site pairs have an average difference in concentration more than a certain value (default = 0)
- Whether the area has at least a certain percent chance of exceeding 85% of the NAAQS (default = 80% chance)

In other words, the New Sites tools looks for places where the closest monitors have contrasting concentration levels or air quality patterns and are far enough apart that there is reason to investigate whether the area in between may be inadequately represented by neighboring monitors. If such a place is also at risk of coming close to or exceeding the standard, then this tool recommends a new site for consideration.

Since the user may adjust any of the criteria, there are an almost infinite number of criteria combinations that could be evaluated. For simplicity, an initial base run was done using only the defaults. These are the results presented here. However, the tool may be rerun at any time with modified criteria.

Since one of the criteria involves referencing the NAAQS, there are multiple maps depending on both pollutant and type of standard. These are as follows:

- PM2.5 (Continuous)
  - Daily NAAQS
  - Annual NAAQS
- PM2.5 (3-Day FRM)
  - Daily NAAQS
  - Annual NAAQS
- PM2.5 (6-Day FRM)

- Daily NAAQS
- Annual NAAQS

- Ozone
  - 8-Hour NAAQS

Sites on the final maps fall into three categories:

- Black circles = sites in site pairs that do not meet all of the criteria (other than comparison to the NAAQS) – these potentially trigger placement of a new site between them and their neighbor <u>if</u> the area between has a probability over the user-defined threshold percentage of exceeding 85% of the NAAQS.
- Gray circles = sites in site pairs that meet all of the criteria (other than comparison to the NAAQS) – these do not trigger placement of a new site
- Blue triangles = proposed new sites, based on the user-selected criteria
-

Figure 2.13: Continuous PM2.5 – Daily NAAQS

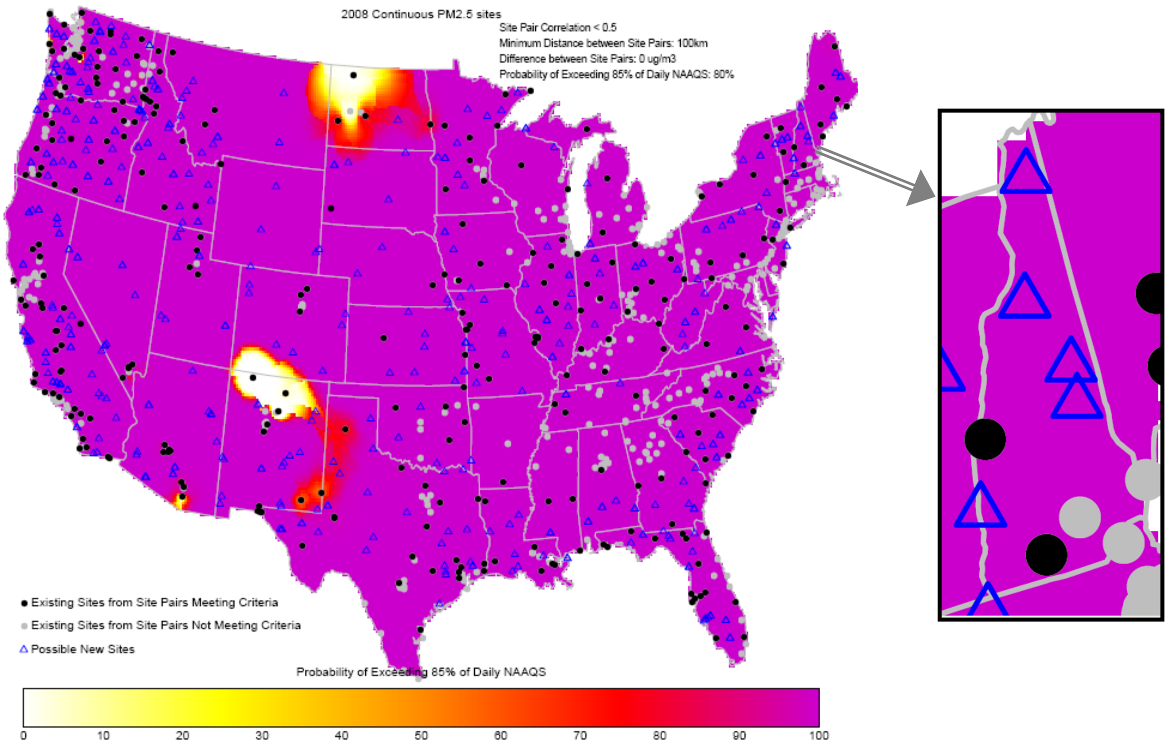


Figure 2.14: Continuous PM2.5 – Annual NAAQS

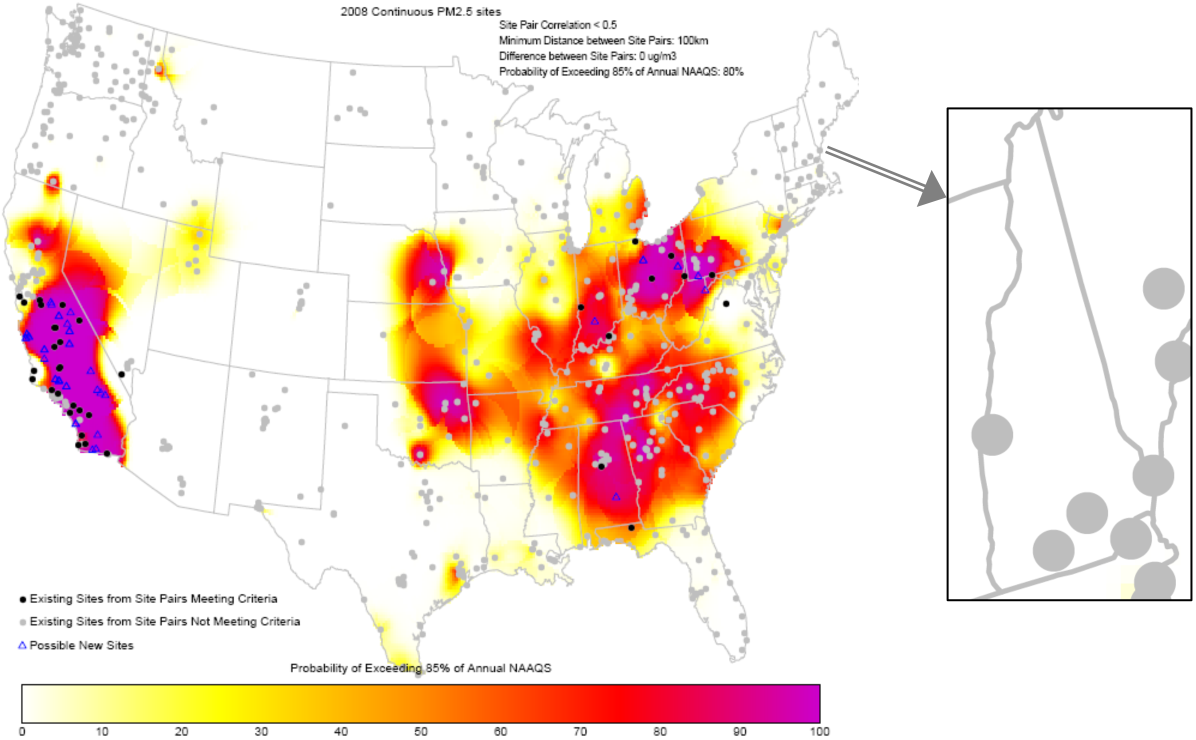


Figure 2.15: 3-Day FRM – Daily NAAQS

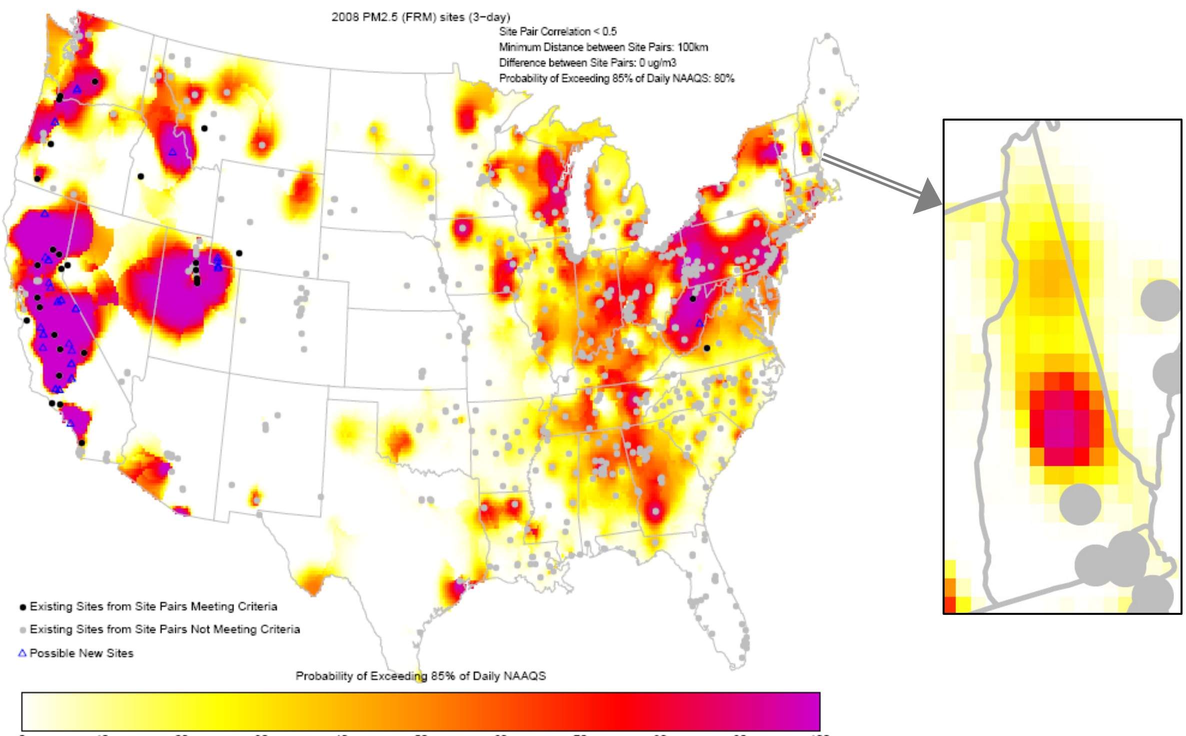


Figure 2.16: 3-Day FRM – Annual NAAQS

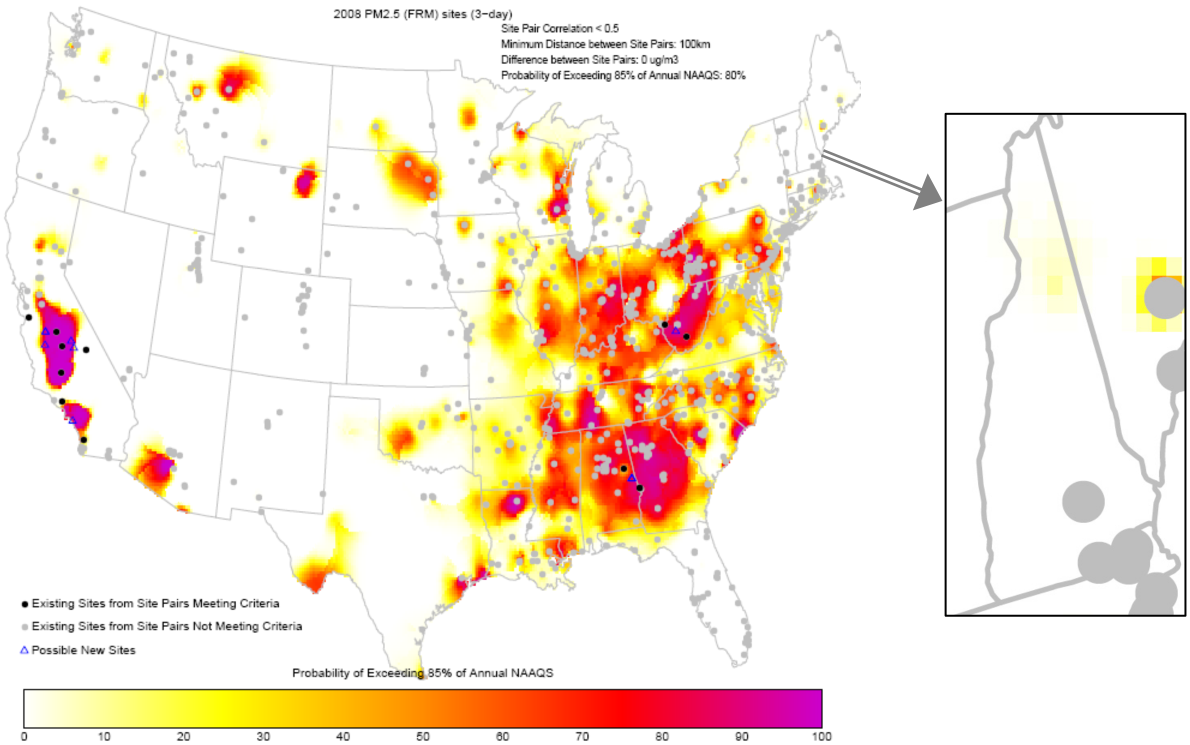


Figure 2.17: 6-Day FRM – Daily NAAQS

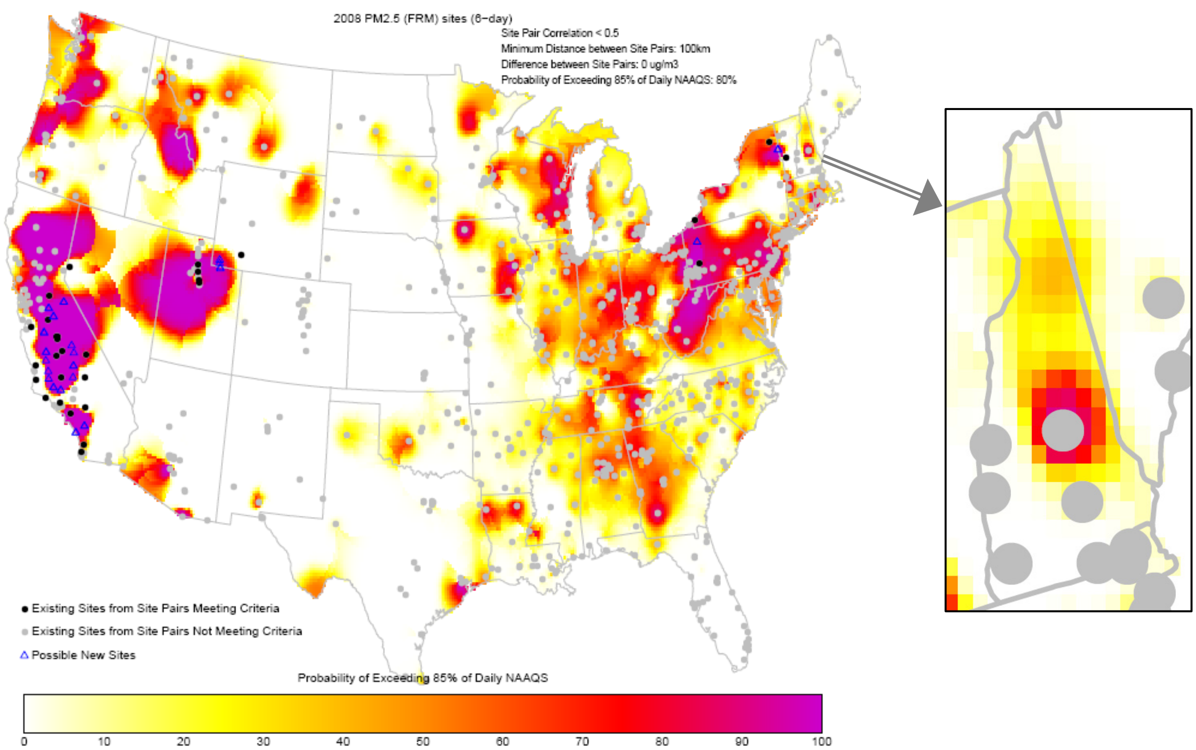
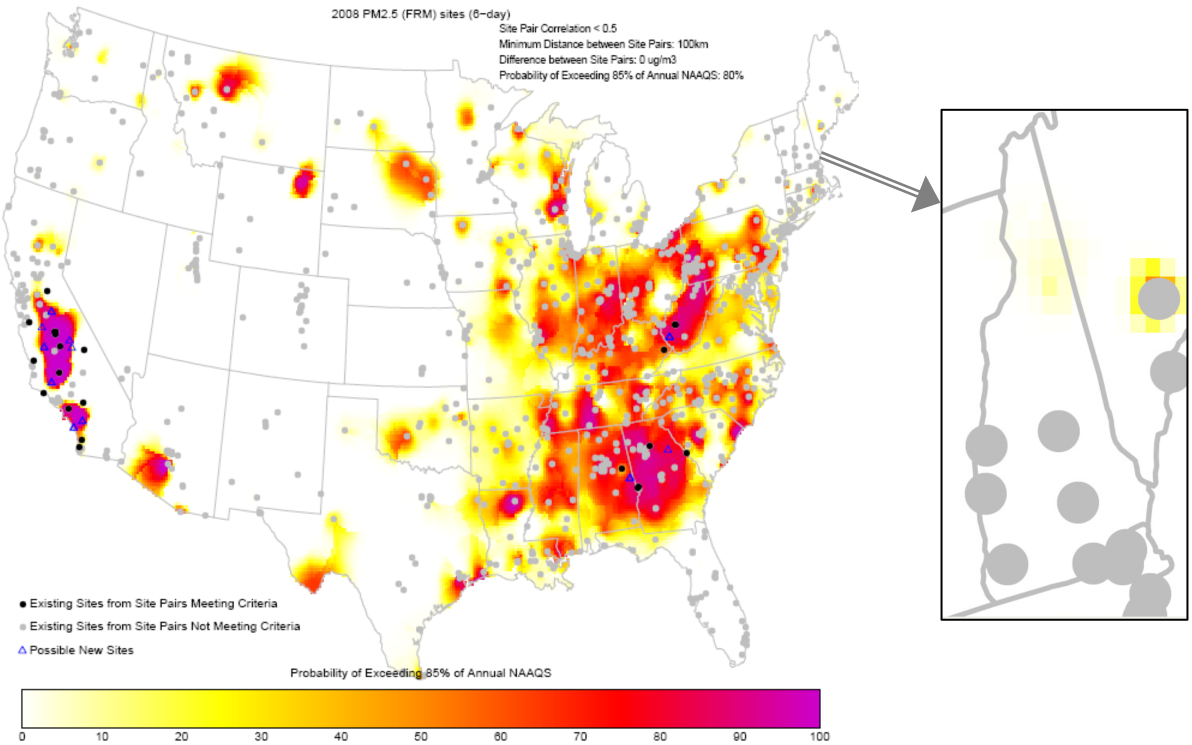


Figure 2.18: 6-Day FRM – Annual NAAQS



For none of the PM2.5 methods does any part of New Hampshire qualify as having at least an 80% probability of exceeding 85% of the annual NAAQS. Thus no new sites appear in the annual NAAQS cases.

Based on FRM data, some areas in the mountains do show potential for exceeding 85% of the daily NAAQS. However, none of the 3-day and 6-day FRM sites in New Hampshire meet the criteria necessary to prompt additional sites.

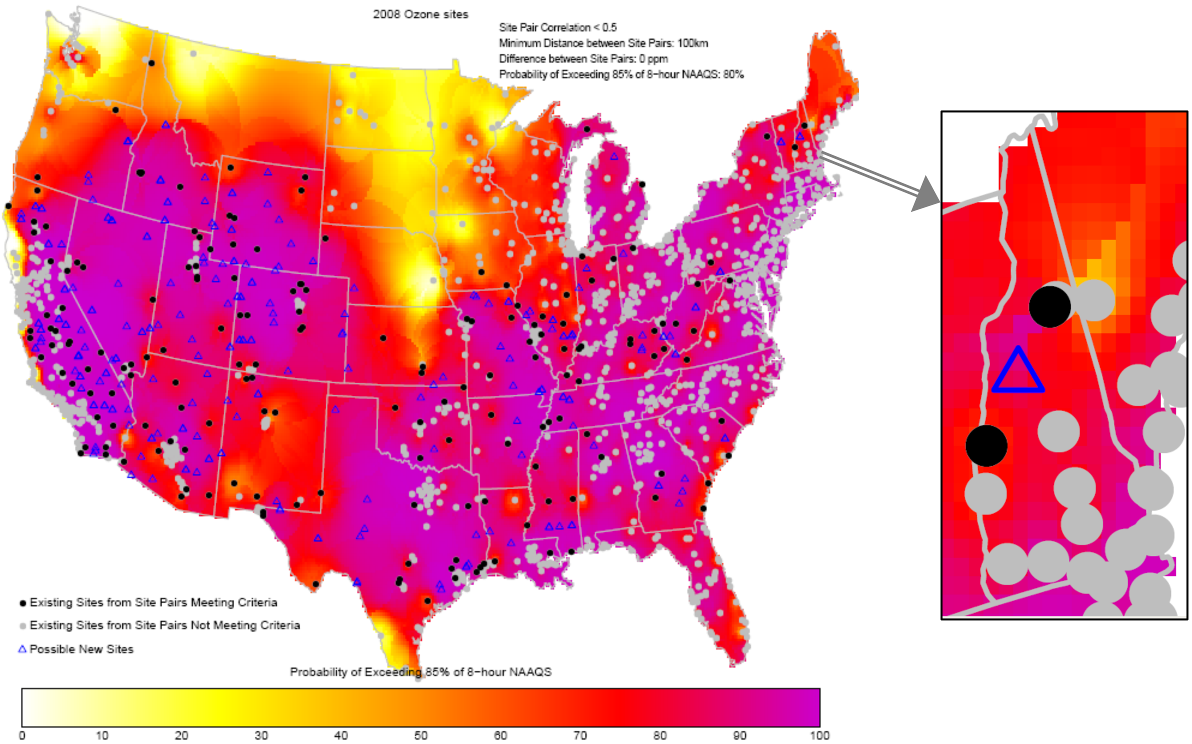
By contrast, according to the continuous PM2.5 data map, almost every part of the country has a 100% probability of exceeding 85% of the daily NAAQS! However, please note the following qualifying statement by the tool suite's author, Michael Rizzo, in Network Assessment Analyses and Tools Documentation:

"The probability was calculated by interpolating the 2006-2008 design values for each pollutant across a 12 km by 12 km grid across the continental United States."…"Because of the completeness criteria for the PM2.5 NAAQS, many continuous sites did not have a valid design value. The probabilities of exceeding 85% of the NAAQS for the continuous sites are, therefore, less reliable than their FRM/FEM counterparts. It was assumed that the final design values had an error of 10%, and through error propagation, a standard deviation for each grid cell was calculated and used to estimate the probability for a grid cell to exceed 85% of the NAAQS."

Thus, it is likely that these probabilities as calculated from continuous data are inaccurate and overly conservative. Not only this, but the continuous PM2.5 network is incomplete due to the absence of the Keene site.

The continuous PM2.5 results add five new sites in New Hampshire. If the Keene site had been included, it may have negated the new site in southwestern New Hampshire along the Vermont border. The other new sites are all in the northern part of the state. Considering that the comparison against the NAAQS is inflated throughout, these new sites would probably not have been added if the analysis were based on more complete data. In fact, the old site at Camp Dodge showed that PM2.5 levels in northern regions are probably low enough not to require such intensive PM2.5 monitoring.

Figure 2.19: Ozone – 8-Hour NAAQS



According to this analysis, much of New Hampshire has a high probability of exceeding 85% of the 8-hour ozone NAAQS. Due to the extensive monitoring coverage of the southern part of the state, however, no southern sites met the criteria for new sites.

Only one new ozone site is suggested to fill the gap between Lebanon in the west and the summit of Mount Washington in the north. However, note that Camp Dodge at the base of Mount Washington does not meet the criteria. This suggests that the new site is being driven by the highly unique summit conditions, which may not be appropriate criteria for additional base-elevation sites.

<u>Removal Bias Tool</u>

The final analysis tool, the Removal Bias, requires the user to select a monitor that is currently in the network but is being considered for discontinuation. The tool helps determine whether, without that monitor, the area's pollutant levels would be over- or under-estimated by the remaining neighboring monitors. The result of the analysis provides the available design value, as an indicator of concentrations at the site, and an average bias.

The average bias is the difference in concentration between what would have been interpolated based on surrounding monitors if the monitor did not exist versus what has actually been measured there. If the bias is positive, pollutant concentrations at that location would be overestimated without the monitor. If the bias is negative, pollutant concentrations at that location would be underestimated without the monitor. Thus, a positive bias indicates that removing the monitor would lead to conservatively high assumptions about the location's air quality; a negative bias shows that loss of the monitor would mean loss of peak concentration data from the area.

Claremont

For demonstration, this tool was run for Claremont, a site that was just discontinued last year. The tool was run based on ozone and 6-day FRM PM2.5.

For ozone, the 2006-2008 design value was 0.068ppm, and the removal bias was 0.003ppm. This means that, without Claremont, surrounding sites could be used to estimate concentrations in that area within about 0.003ppm on average, and that this would be slightly higher than what would have actually been monitored. Therefore, Claremont's removal did not harm the integrity of the ozone network.

In the case of PM2.5, based on 6-day FRM data, the 2006-2008 annual design value was 8.9 ug/m3, the 2006-2008 daily design value was 21 ug/m3, and the average bias was -0.2 ug/m3. The negative bias indicates that interpolation by surrounding sites would underestimate the PM2.5 concentrations in Claremont by about 0.2 ug/m3. Although this is a negative bias, it is a very negligible value. Moreover, the design values are well below the NAAQS.

Based on these results, the removal of Claremont was an acceptable choice that did not significantly affect the value of the overall ozone and PM2.5 networks.

Concord/Manchester/Nashua

As discussed under the correlation matrix results for ozone, Concord and Manchester are in close proximity to one another (24 km), represent city environments, and produce similar ozone data (relative difference of 0.0695, correlation R2 of 0.9195). Similarly, Manchester and Nashua are 31 km apart, both highly urban, and have a strong correlation (R2=0.9058) and low relative difference (0.0991). This situation is compounded by the upcoming move of Manchester's ozone to the new NCore site in the adjacent town of Londonderry. As an NCore requirement, ozone monitoring must operate in Londonderry. Therefore, the removal bias tool was utilized to explore whether Concord or Nashua could safely be removed from the ozone network.

Concord's 2006-2008 design value was reported as 0.070 ppm, which was slightly higher than Manchester's design value of 0.068 ppm. Removal of Concord produced a positive bias of 0.001 ppm. Nashua's 2006-2008 design value was 0.073 ppm, higher than either of the other two sites, and its removal gave a positive bias of 0.002 ppm. It should be noted, however, that some adjacent sites used to develop the bias for Nashua are those over the Massachusetts border.

Because Nashua had the highest design value, it would not be the preferred choice if one were to be removed, since it represents the highest monitored concentrations in the region. Even though the bias is positive, this is likely due to monitors in Massachusetts which record higher ozone concentrations. To maintain a self-sufficient network, it is important to maintain this border site rather than interpolate from other state's data.

Concord's higher design value indicates that it may tend higher than Manchester, and for that reason need to remain. However, its bias was positive and very small, so its concentrations could be fairly and conservatively interpolated from surrounding data. This suggests that the necessity of ozone monitoring should stay in question. However, it would be premature to make this change before comparing ozone data from Londonderry once a sufficient dataset is available.

Portsmouth/Rye

Portsmouth and Rye are two other sites identified through the correlation matrix as experiencing similar ozone concentrations. These sites had a relative difference of 0.0734 and a correlation R2 of 0.8856. The removal bias tool was applied to investigate whether one of these two sites, both on the coast and only 4 km apart, is redundant.

Running the removal bias tool for ozone on each site showed that removal of Portsmouth would yield a positive bias of 0.002 ppm, while removal of Rye would produce a negative bias of -0.002 ppm. Rye also had the higher 2006-2008 design value of 0.079 ppm (versus 0.073 ppm for Portsmouth). These results indicate that Rye is the more critical site to keep in the ozone network. Rye captures the highest concentrations, including a design value above the current ozone NAAQS of 0.075 ppm. Porstmouth's design value is just below the NAAQS, and, without a monitor, ozone levels there would be somewhat, though not grossly, overestimated. Though there is no intention to remove ozone monitoring from either site in the immediate future, NHDES will continue to evaluate the most efficient options for ozone monitoring on the seacoast.

Summary of Network Assessment Tools Results

PM2.5

Network Overview

New Hampshire currently operates continuous PM2.5 monitors at five sites: Portsmouth, Manchester, Pack Monadnock summit, Keene, and Lebanon. Three of these monitors are FEM BAMs, and two are TEOMs. The FEM sites are Portsmouth, Keene, and Lebanon. Manchester currently operates a TEOM, but the final move of Manchester's equipment to the new NCore site in Londonderry will include replacement of the TEOM with an FEM BAM. The TEOM on Pack Monadnock will also be replaced with a BAM as part of its upgrade to an NCore site. Although the continuous PM2.5 network is being transitioned to the BAM, these changes are recent and ongoing; Keene and Lebanon BAMs were installed near of the end of 2008 and Portsmouth's at the beginning of 2010. Therefore, most of the data driving the network tool assessment were based on the TEOM and FDMS monitors that preceded the BAM.

New Hampshire's FRM network consists of three sites with 1-in-3 and two with 1-in-6 day sampling. The 1-in-3 sites are Nashua, Pembroke, and Portsmouth. The 1-in-6 day sites are Laconia and Keene. Lebanon and Claremont are included in the network assessment tools; however, Claremont was shut down and Lebanon's FRM sampling was reduced to once monthly at the end of 2008. Moreover, NHDES plans on extending the FRM sampling interval to 1-in-6 at Nashua and 1-in-12 in Portsmouth.

Combining the FEM and FRM networks, by the beginning of 2011, New Hampshire plans to be monitoring PM2.5 with a method approved for comparison against the NAAQS at the following sites:

- Londonderry – Continuous (BAM)
- Pack Monadnock – Continous (BAM)
- Lebanon – Continuous (BAM)
- Keene – Continuous (BAM); 1-in-6 FRM
- Portsmouth – Continuous (BAM); 1-in-12 FRM
- Pembroke – 1-in-3 FRM
- Laconia – 1-in-6 FRM
- Nashua – 1-in-6 FRM

The network tools incorporated data, as continuous or FRM, from each of the above sites. The exception was Londonderry, which is not yet operational; however, the tools did use data from the existing PM2.5 site in nearby Manchester.

Network Analysis Results

The correlation matrix tool reveals from continuous data that Portsmouth, Manchester, and Pack Monadnock fill distinct roles in the network. None have particularly high correlations, and each has a fairly high relative difference in concentrations. Assuming that Londonderry and Manchester data are consistent, the seacoast, south-central urban region, and southern high elevations are represented without redundancy.

From FRM data, the correlation matrix shows that Keene and Laconia are very different, Nashua and Pembroke are quite similar, and all other site combinations have moderate correlations and relative differences. Thus, only one area of potential redundancy exists along the I-93 corridor between Pembroke and Nashua data. Since an FEM BAM will soon be added between them at the NCore site Londonderry, the question may be raised whether PM2.5 monitoring is needed at all three locations. This will be reassessed in future networks, once data from Londonderry can be added to the analysis. In the meantime, Nashua's FRM sampling frequency is being lengthened from 1-in-3 to 1-in-6 days.

The area served tool reveals that the continuous and FRM networks, treated separately, have a balanced distribution throughout the state. The FRM network has two monitors at the north and south ends of the I-93 corridor (Pembroke and Nashua), while this region's only continuous monitor is centrally located in Manchester along the same transect. The FRM network does not have a monitor along the northwestern border, but here a continuous FEM BAM operates in Lebanon. Likewise, there is no continuous monitor in the Lakes Region, but there is a 1-in-6 FRM in Laconia on the southern side of the Lakes. The only region without PM2.5 monitoring is the far north; previous monitoring existed at Camp Dodge, but removal was justified based on persistently low concentrations. Thus, the combined continuous and FRM networks place a monitor in each major region: southwest (Keene), southeast coast (Portsmouth), central urban/I-93 corridor (Nashua/Pembroke/Manchester), and northwest (Lebanon). Moreover, a Census map of 2000 population density shows that these sites lie in the most populated areas within each region.

Based on population growth between 1990 and 2008, the population animation tool does reveal three potential gaps in the PM2.5 network: Moultonborough (north of the Lakes Region), a swath north of Lake Sunapee (on the northwestern side of the state), and the Danville/Kingston area (central Rockingham County). While Moultonborough has the highest rate of growth in the Lakes Region, Laconia has the highest population density in recent years. To preserve historical consistency and serve the current population, Laconia is considered sufficient representation for this area. However, this points out the need to keep watch on development happening north of the Lakes. Similarly, in the case of Lake Sunapee, nearby Lebanon has slower growth but no less significant a 2000 population density. Again, this is an area to watch, but Lebanon is considered adequate representation of the northwestern portion of the state which encompasses the Lake Sunapee populations.

Unlike the previous two examples, the Danville/Kingston area does not have a nearby monitor to represent its both growing and currently significant population. It is far enough inland that the data collected at Portsmouth may not be representative; Portsmouth is directly on the coast and subject to moderated temperatures, wind gusts, and sea breezes that may not occur deeper inland. On its western side, Pembroke, Manchester, and Nashua are much more populated and exist along a well-traveled highway. Thus, while conservative, they may not be accurate estimates of the residential areas of central Rockingham County. NHDES does not currently have plans to add a monitoring site in this area, but will put this option under further consideration.

Ozone

Network Overview

New Hampshire's ozone network consists of 11 sites as follows:

- Laconia
- Keene
- Camp Dodge
- Lebanon
- Manchester
- Nashua
- Pack Monadnock
- Concord
- Portsmouth
- Rye
- Mount Washington

The network assessment tools analyze data from each of these sites, except the summit of Mount Washington, which was operated by UNH until last year. The tools also utilize data from

Claremont, but this site was removed in 2008. There are no changes proposed to the ozone network for the upcoming year.

Network Analysis Results

From the correlation matrix, most site pairs have a moderate correlation and relative difference. Some sites do stand out as being particularly distinct; these include Camp Dodge and Pack Monadnock, the most rural sites in the network. Camp Dodge is furthest from transport sources, and, at the base of the mountains, often experiences cooler, cloudier weather than southerly locations. Pack Monadnock is in the southwestern part of the state at comparatively high elevation; the elevation produces weather, including rain and fog, that often contrasts with surface sites, and it is also in a position to receive long-range transport ahead of other sites. Thus, differing air quality patterns follow from these environmental distinctions. Portsmouth and Rye also have low correlations with some other sites, mostly those further away, such up north or to the west. In addition to distance, sea breezes and varying temperatures in the microclimate of the coastline account for these singularities.

The correlation matrix also points to strong similarities among the ozone concentrations monitored at the three most urban sites (Concord, Nashua, and Manchester) and between the two coastal sites (Portsmouth and Rye). The removal bias tool was employed to test the consequences of removing one site in each area.

Of the urban sites, Manchester's ozone equipment will be moving to the new NCore site in Londonderry, so this ozone monitor must remain in place. Based on the removal bias tool, Nashua has the highest design value, making it a critical high-concentration site at the state border. This leaves the option of discontinuing ozone in Concord. Concord's 2006-2008 design value is 0.070 ppm, lower than Nashua's (0.073 ppm), but higher than Manchester's (0.068 ppm). Its removal bias is a positive 0.001 ppm, indicating that the site's ozone levels would be conservatively estimated from surrounding monitors. This will be put under consideration, but additional analysis should be made with the inclusion of Londonderry data once it is available. Thus, NHDES does not have any current plans to subtract Concord from the ozone network.

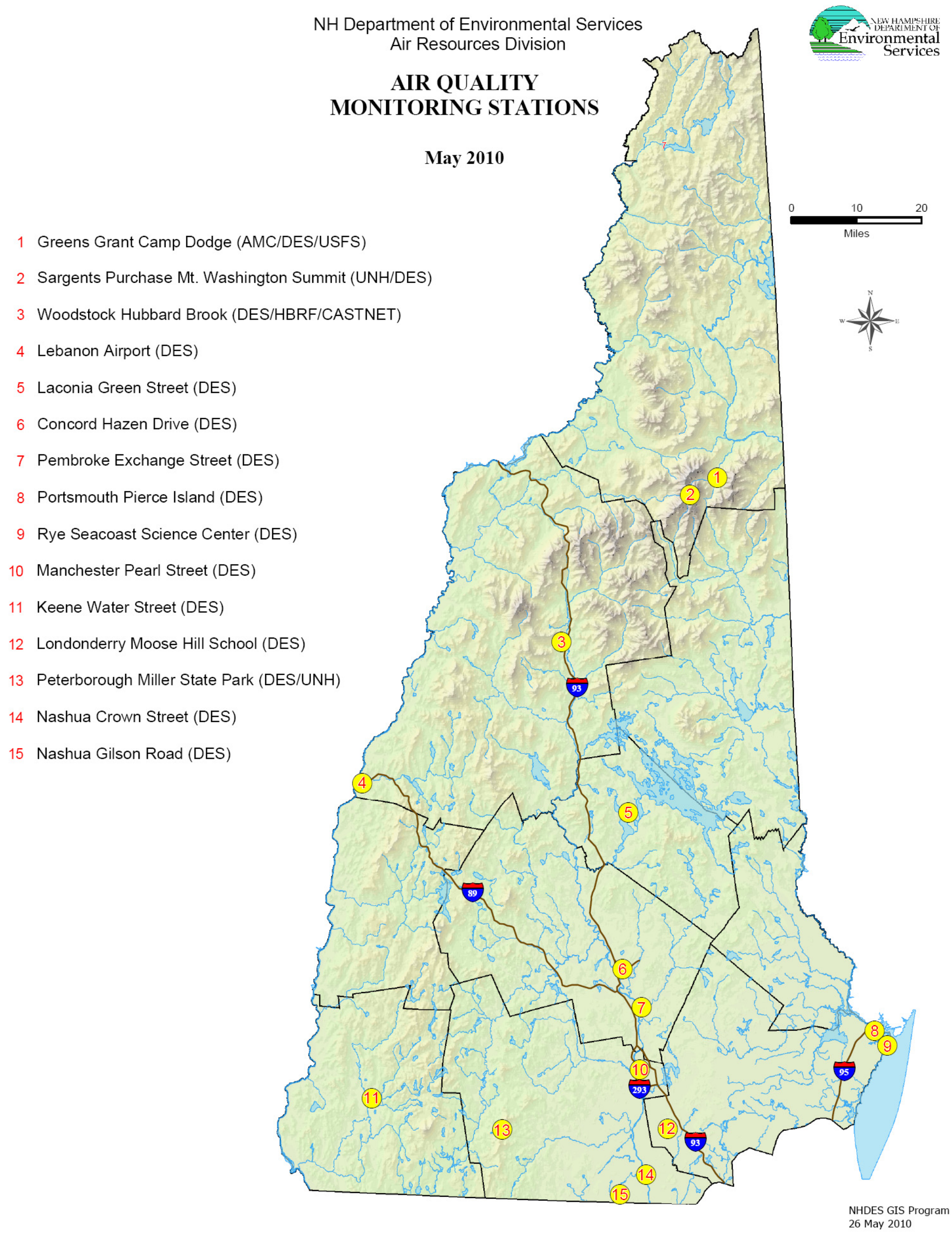
On the seacoast, Rye has a higher design value than Portsmouth (0.079 ppm vs 0.073 ppm); this design value is also above the current ozone NAAQS. According to the removal bias tool, the bias for Portsmouth is a positive 0.002 ppm, while that for Rye is a negative -0.002 ppm. Therefore, Portsmouth's ozone levels could be conservatively approximated, but Rye exhibits peak concentrations for the coast that would be lost without continued monitoring. Though there is no intention to remove ozone monitoring from either site in the immediate future, NHDES will continue to evaluate the most efficient options for ozone monitoring on the seacoast.

The current ozone network effectively captures transport near the state borders via these sites from northwest to southeast: Lebanon, Keene, Pack Monadnock, Nashua, Rye, and Portsmouth. Inland sites are strategically located along the I-93 corridor in Manchester and Concord, and Laconia represents the popular residential and recreational Lakes Region of central New Hampshire. The rural north has surface coverage by Camp Dodge, while a monitor at the summit of the state's highest peak, Mount Washington, measures ozone at high elevation. Except for these northern sites in the White Mountains and Pack Monadnock's summit, each site is located in areas that, based on the 2000 Census, are currently the most densely populated in each region.

The area served tool also illustrates that the distribution of existing sites is sound. The largest tracts exist in the least populated regions, including those to the north and west. Concord, Manchester, and Nashua break up the urban corridor along I-93 into smaller sections from north to south. Portsmouth and Rye share the seacoast. Thus, the most densely populated areas have the greatest monitoring coverage.

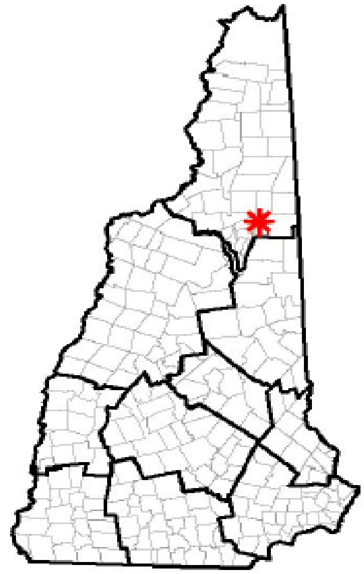
Nevertheless, similar to PM2.5, the population animation suggests that there are some areas undergoing significant growth that do have an ozone monitor: Moultonborough (north of the Lakes Region), a swath north of Lake Sunapee (on the northwestern side of the state), and the Danville/Kingston area (central Rockingham County). Per the above discussion for the PM2.5 monitors, Laconia and Lebanon appear adequate to represent their respective regions based on current population densities. Nevertheless, the Moultonborough and Lake Sunapee areas should remain under scrutiny in future years. Also, with multiple sites along I-93 and dual coverage on the seacoast, there remains a gap in central Rockingham County for ozone as well as PM2.5. Again, NHDES will examine the need for ozone and PM2.5 monitoring in this vicinity, although no current plans are underway to make this addition.

Part 3: Individual Station information



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.:	+44.290556 -71.225000 335 1995



Site Description

This air monitoring station is located in a rural forested area right 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. DES operates this station in cooperation with the Appalachian Mountain Club and the US Forest Service.

Pollutants/Parameters

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

Recent Changes

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

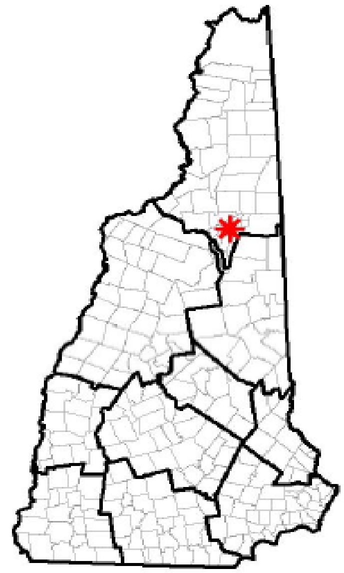
Proposed/Planned Changes

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

Mt. Washington Summit

General Information

AQS ID:	33-007-4001	Latitude:	+44.278333
Town:	Sargents Purchase	Longitude:	-71.302500
Address:	Observatory	Elevation (m):	1,917
County:	Coos	Year Est.:	1990
Spatial Scale:	Regional		



Site Description

This air monitoring station is located at the top of Mt. Washington in the Yankee Building. UNH also monitors for several pollutants from this site.

Pollutants/Parameters

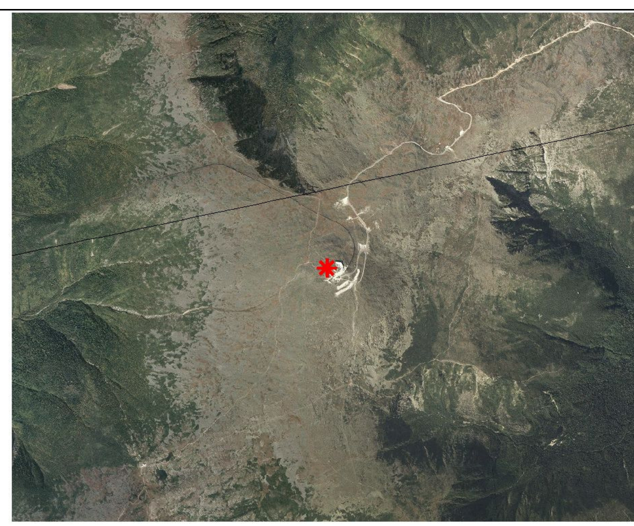
Ozone – Wind Speed – Wind Direction – CO (Trace) – SO2 (Trace) – NOY (Trace). For more information relative to these parameters please go to the following UNH link: http://soot.sr.unh.edu/airmap/archive

Recent Changes

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

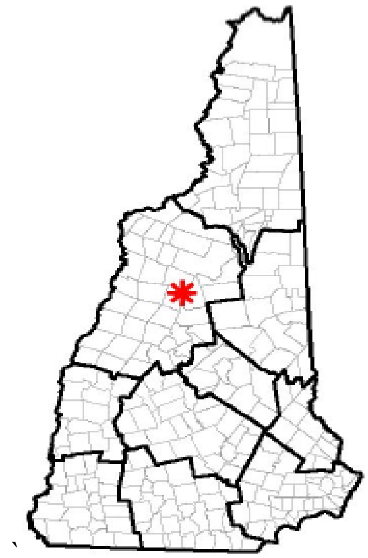
Proposed/Planned Changes

DES plans to work with UNH to develop a comprehensive air monitoring station in the Yankee Building in the near future.



Hubbard Brook, Woodstock

General Information			
AQS ID:	33-009-8001	Latitude:	+43.943056
Town:	Woodstock	Longitude:	-71.703333
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 structure is specifically designed for climate-controlled scientific operations. It measures approximately 8' wide by 10' long. This is a CASTNET station and DES' involvement is limited to capturing the ozone data for real-time mapping purposes.

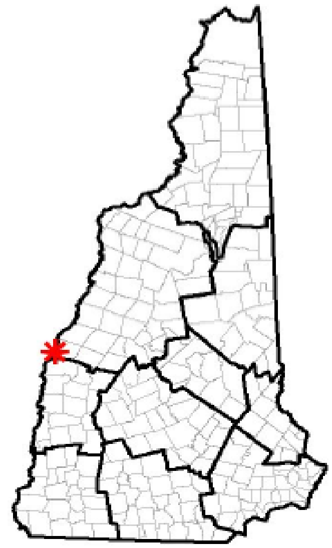
Pollutants/Parameters
Ozone - CASTNET – NADP (Operated by EPA)

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

Proposed/Planned Changes
DES 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.:	+43.629570 -72.226083 167 2005



Site Description

This 8’ wide by 10’ long air monitoring station is located at the northeast edge of the Lebanon Municipal Airport in a commercial area. The filter based PM2.5 sampler is located on a deck on top of the trailer.

Pollutants/Parameters

Ozone - Continuous PM2.5 (BAM) - Wind Speed - Wind Direction - Temperature

Recent Changes

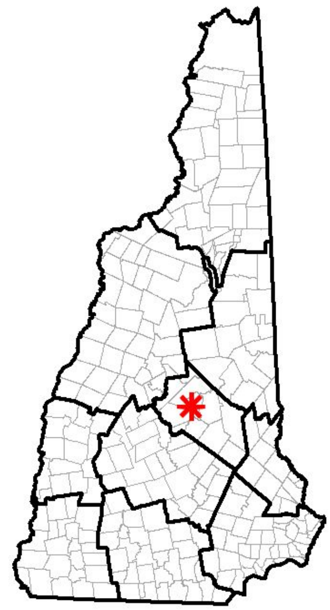
DES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

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

Green Street, Laconia

General Information			
AQS ID:	33-001-2004	Latitude:	+43.565279
Town:	Laconia	Longitude:	-71.495833
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. Filter-based PM2.5 samplers are located on platforms approximately 30m from the structure.

Pollutants/Parameters

Ozone – PM2.5 (one sample every six days) – Wind Speed – Wind Direction – Temperature - Precipitation

Recent Changes

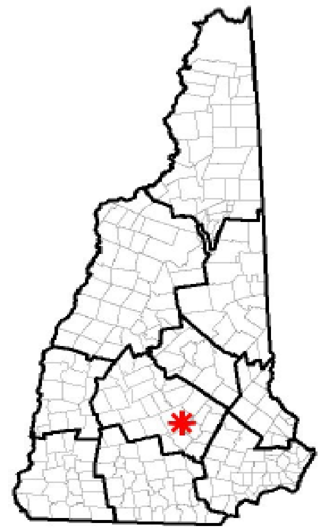
DES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

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

Hazen Station, Concord

General Information			
AQS ID:	33-013-1007	Latitude:	+43.218491
Town:	Concord	Longitude:	-71.458270
Address:	27 Hazen Dr.	Elevation (m):	100
County:	Merrimack	Year Est.:	2004
Spatial Scale:	Neighborhood		



Site Description

This station is located in an urban residential neighborhood and is surrounded by a large home for the elderly and several elementary schools. This air monitoring station is at the ideal location for protecting a susceptible population in Concord and measures 8' wide by 18' long. Its insulated, box-type structure is specifically designed for climate-controlled scientific functions.

Pollutants/Parameters

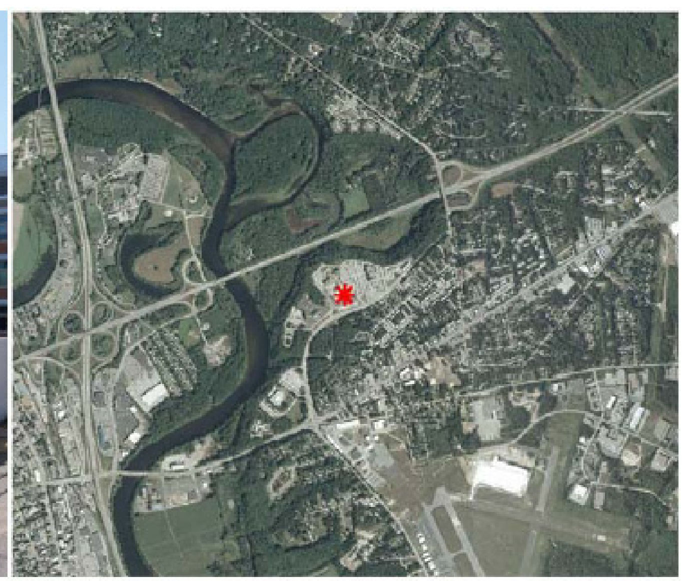
Ozone - Temperature – Wind Speed – Wind Direction. DES also uses this station as an air monitoring laboratory and a staging area for field-ready equipment.

Recent Changes

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

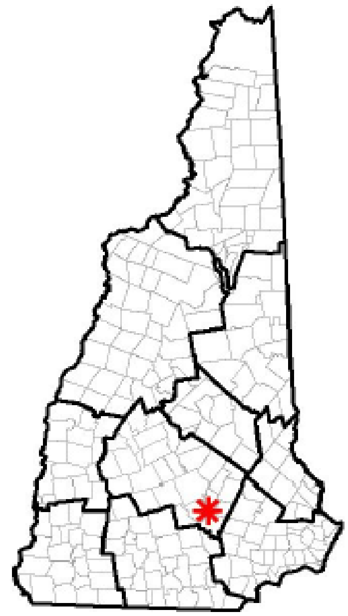
Proposed/Planned Changes

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



Exchange Street, Pembroke

General Information			
AQS ID:	33-013-1006	Latitude:	+43.132444
Town:	Pembroke	Longitude:	-71.458270
Address:	Pleasant St.	Elevation (m):	100
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. The filter based PM2.5 samplers are located on a deck on top of the structure.

Pollutants/Parameters

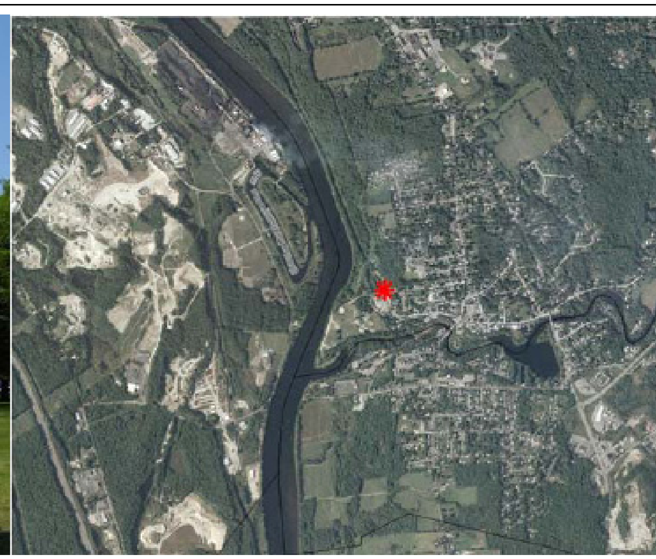
Sulfur Dioxide – PM2.5 Filter Based (one sample every three days) – PM2.5 Filter Based Audit (one sample every six days) – Temperature – Wind Speed – Wind Direction.

Recent Changes

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

Proposed/Planned Changes

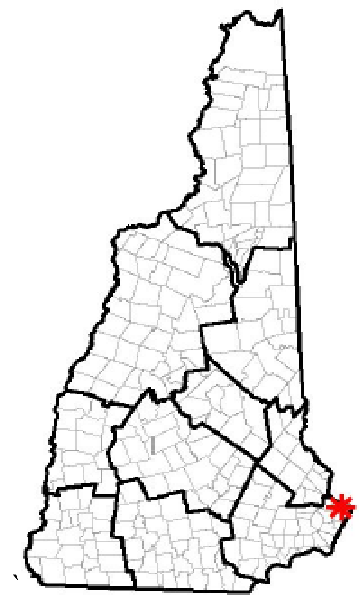
DES is not planning any significant changes to this station into the foreseeable future.



Pierce Island, Portsmouth

General Information

AQS ID:	33-015-0014	Latitude:	+43.075278
Town:	Portsmouth	Longitude:	-70.748056
Address:	Pierce Island	Elevation (m):	4
County:	Rockingham	Year Est.:	2001
Spatial Scale:	Neighborhood		



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 PM2.5 samplers are located on platforms approximately 8m from the shelter.

Pollutants/Parameters

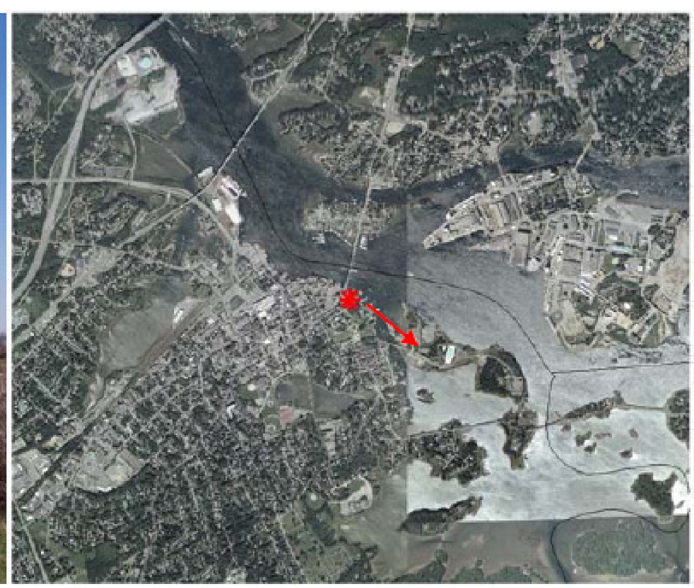
Ozone – PM2.5 Filter Based (one sample every three days) – PM2.5 Continuous (TEOM) – PM10 Filter Based (one sample every six days) – Sulfur Dioxide – Temperature – Wind Speed – Wind Direction

Recent Changes

DES replaced the PM2.5 TEOM with a PM2.5 BAM during January 2010.

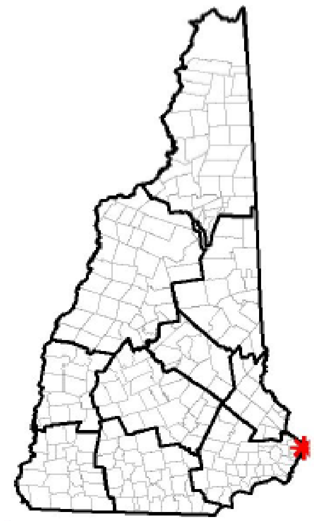
Proposed/Planned Changes

DES is planning on initiating PM10 colocation sampling at this station in conjunction with discontinuing PM10 sampling in Manchester.



Seacoast Science Center, Rye

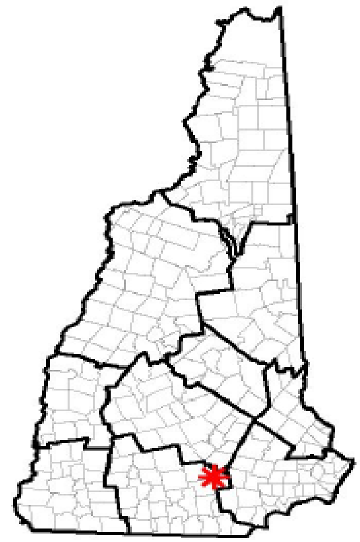
General Information			
AQS ID:	33-015-0016	Latitude:	+43.047475
Town:	Rye	Longitude:	-70.713839
Address:	Seacoast Science Ctr.	Elevation (m):	10
		Year Est.:	2003
County:	Rockingham		
Spatial Scale:	Neighborhood		



Site Description
This station is located in a suburban residential 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. DES 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
DES did not make any significant changes to this station during this review period.
Proposed/Planned Changes
DES is not planning any significant changes to this station into the foreseeable future.

Pearl Street, Manchester

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-011-0020 Manchester Pearl Street Hillsborough Urban	Latitude: Longitude: Elevation (m): Year Est.:	+43.000556 -71.468056 61 2001



Site Description

This air monitoring station is located in a commercial area near the center of the city of Manchester. This construction type trailer is approximately 8’ wide by 16’ long. The filter based PM samplers are located on a deck on top of the trailer.

Pollutants/Parameters

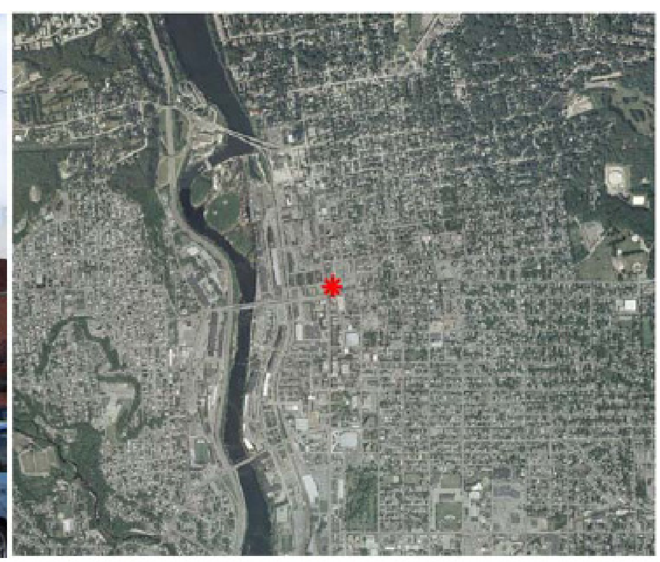
Carbon Monoxide – Nitrogen Dioxide – Ozone – PM10 Filter Based (one sample every six days) – PM10 colocate – PM2.5 continuous (TEOM) – Sulfur Dioxide – Temperature – Wind Speed – Wind Direction

Recent Changes

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

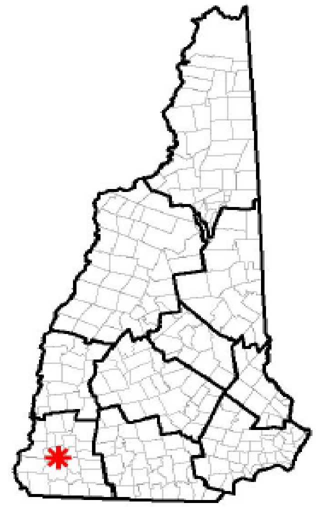
Proposed/Planned Changes

Please refer to the Future Plans Section of this Annual Review Plan for specifics on future plans for this station.



Water Street, Keene

General Information			
AQS ID:	33-005-0007	Latitude:	+42.930556
Town:	Keene	Longitude:	-72.277778
Address:	Railroad Street	Elevation (m):	145
County:	Cheshire	Year Est.:	1989
Spatial Scale:	Neighborhood		



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 PM2.5 sampler is located on the rooftop deck.

Pollutants/Parameters

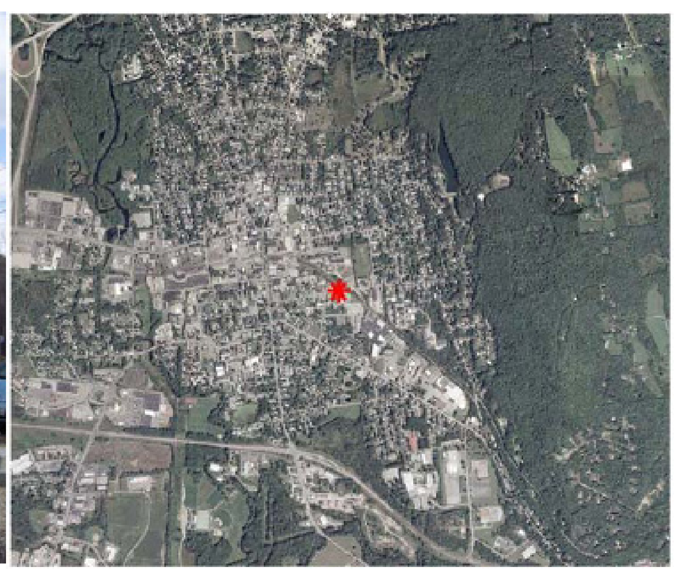
Ozone - PM2.5 Filter Based (one sample every six days) - PM2.5 Filter Based Audit (collocated – every six days) - PM2.5 Continuous (BAM) – PM2.5 Continuous (TEOM) - Wind Speed - Wind Direction - Temperature

Recent Changes

DES discontinued PM2.5 TEOM monitoring during October 2009.

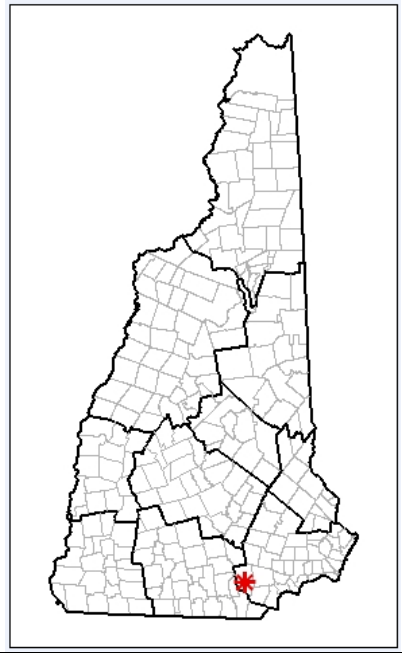
Proposed/Planned Changes

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



Moose Hill, Londonderry

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-015-0018 Londonderry Moose Hill Sch. Rockingham Neighborhood	Latitude: Longitude: Elevation (m): Year Est.:	+42.514496 -71.224775 104 2009



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 PM2.5 samplers are located on platforms approximately 15 m from the structure.

Pollutants/Parameters

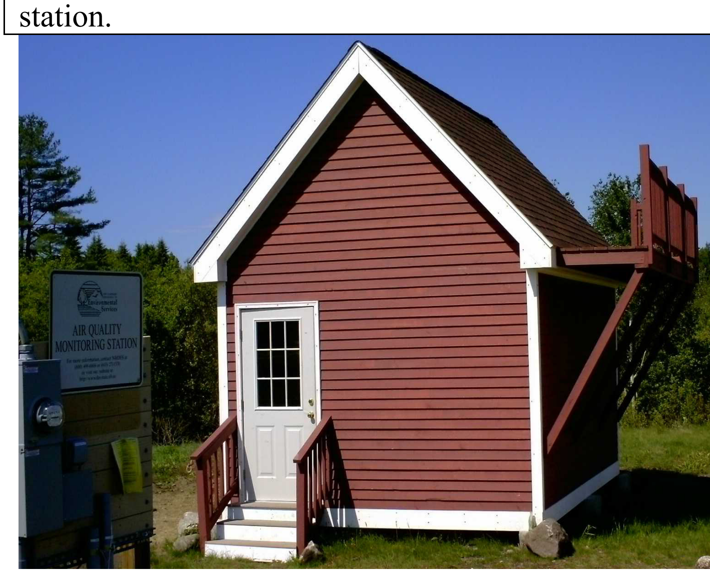
For NCore: PM2.5 Continuous and Filter based – IMPROVE – PM Course – Nitrogen Oxides – Ozone – Sulfur Dioxide (trace) – Carbon Monoxide (trace) – Temperature – Wind Speed – Wind Direction – Relative Humidity.

Recent Changes

New Station

Proposed/Planned Changes

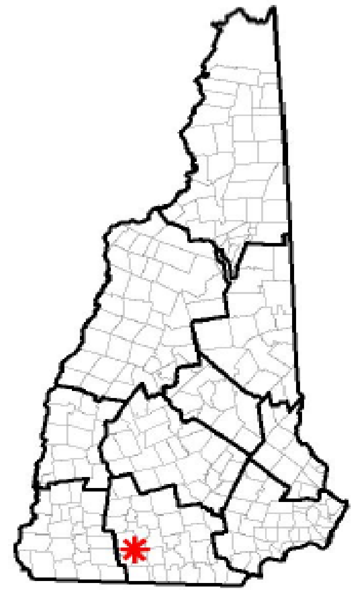
Please refer to the Future Plans Section of this Annual Review Plan for specifics on future plans for this station.



Pack Monadnock Mountain

General Information

AQS ID:	33-011-5001	Latitude:	+42.861901
Town:	Peterborough	Longitude:	-71.878613
Address:	Miller State Park	Elevation (m):	694.6
		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. This stick framed, 15' by 12' structure that houses the air monitoring equipment is historically significant, having been built by the Civilian Conservation Corps. 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 PM2.5 sampler is located on a deck on top of the structure. UNH also monitors numerous parameters from this site.

Pollutants/Parameters

Currently: Ozone – Nitrogen Dioxide – PAMS - PM2.5 continuous (TEOM) – Temperature – Wind Speed – Wind Direction – Relative Humidity – Radiation – Precipitation – Barometric Pressure - IMPROVE.
For NCore: PM2.5 Continuous and Filter based – IMPROVE – PM Course – Nitrogen Oxides – Ozone – Sulfur Dioxide (trace) – Carbon Monoxide (trace) – Temperature – Wind Speed – Wind Direction – Relative Humidity.

Recent Changes

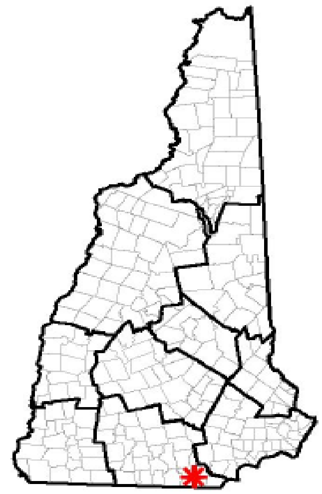
DES did not make any significant changes to this station during this review period.

Proposed/Planned Changes

Please refer to the Future Plans Section of this Annual Review Plan for specifics on future plans for this station.

Crown Street, Nashua

General Information			
AQS ID: Town: Address: County: Spatial Scale:	33-011-1015 Nashua Crown Street Hillsborough Urban	Latitude: Longitude: Elevation (m): Year Est.:	+42.761860 -71.444550 33.5 2005



Site Description

This air monitoring station is located in an urban commercial and residential neighborhood. It is located approximately 30 meters from the Merrimack River and consists of a small fenced-in platform approximately 12' long by 8' wide.

Pollutants/Parameters

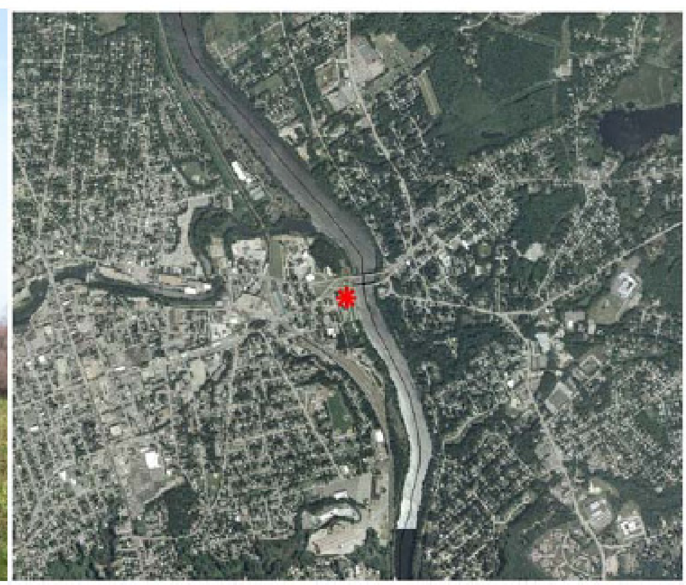
PM2.5 Filter Based (one sample every three days)

Recent Changes

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

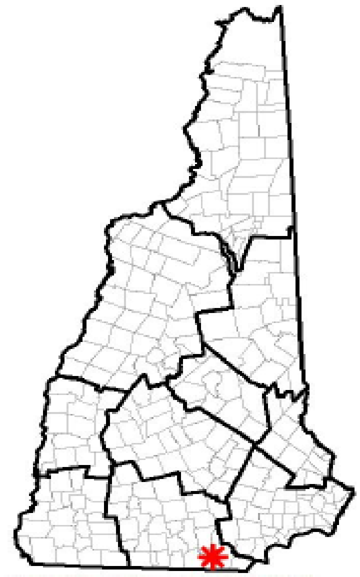
Proposed/Planned Changes

DES is planning to reduce the PM2.5 sampling frequency from 1/3 to 1/6 days.



Gilson Road, Nashua

General Information			
AQS ID:	33-011-1011	Latitude:	+42.720377
Town:	Nashua	Longitude:	-71.523083
Address:	57 Gilson Rd.	Elevation (m):	59
County:	Hillsborough	Year Est.:	2003
Spatial Scale:	Neighborhood		



Site Description

This air monitoring station is located in a suburban residential neighborhood near a Superfund site. DES requires two 8' wide by 16' long trailers to accommodate the equipment needed to measure ambient air parameters, including PAMS. DES collects meteorological data from a tower located on an adjacent building.

Pollutants/Parameters

Ozone - Nitrogen Dioxide – PAMS – Temperature – Wind Speed – Wind Direction – Relative Humidity

Recent Changes

DES initiated temporary collocated wind speed and wind direction monitoring at this station.

Proposed/Planned Changes

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