

# Vermont Annual Air Monitoring Network Plan 2012



Vermont Department of Environmental Conservation  
Air Pollution Control Division  
May 1, 2012

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## Acronyms and Abbreviations

AMTIC - Ambient Monitoring Technical Information Center  
APCD - (Vermont) Air Pollution Control Division  
AQI - Air Quality Index  
BTEX - Benzene, Toluene, Ethylbenzene, Xylene  
CAA - Clean Air Act  
CARB - California Air Resources Board  
CFR - Code of Federal Regulations  
CO - Carbon Monoxide  
CSA - combined statistical area  
EPA - Environmental Protection Agency  
ESC - Environmental Systems Corporation  
FDMS - Filter Dynamic Measurement System  
FEM - Federal Equivalent Method  
FRM - Federal Reference Method  
GIS - geographical information systems  
HAP - hazardous air pollutants  
HAAS - Hazardous Ambient Air Standard  
IC - Ion Chromatography  
IO - inorganic  
MQOs - measurement quality objectives  
MPA - monitoring planning area  
MSA - metropolitan statistical area  
NAAQS - National Ambient Air Quality Standards  
NAMS - national air monitoring station  
NATTS- National Air Toxic Trends Stations network  
NCore - National Core Monitoring Sites  
NECMSA - New England county metropolitan statistical area  
NOX - Oxides of Nitrogen  
NOy - sum of the individual reactive nitrogen oxide species  
NO<sub>2</sub> - Nitrogen Dioxide  
O<sub>3</sub> - Ozone  
OAQPS - Office of Air Quality Planning and Standards  
PIXE- Proton Induced X-ray Emission  
PMSA - primary metropolitan statistical area  
PM<sub>10</sub> - Particulate ≤10 micron aerodynamic particle size  
PM<sub>2.5</sub> - Particulate ≤2.5 micron aerodynamic particle size  
PAH - Polycyclic Aromatic Hydrocarbon  
QA - quality assurance  
QA/QC - quality assurance/quality control  
QAPP - quality assurance project plan  
SLAMS - state and local monitoring stations  
SO<sub>2</sub> - Sulfur Dioxide  
SOP - standard operating procedure  
SPMS - special purpose monitoring stations  
TEOM - Tapered Element Oscillating Microbalance  
TL - trace level  
TOR - Total Organic Reduction  
TSP - total suspended particulate  
TSS - Technical Services Section (Monitoring Section) of the APCD  
VOC - volatile organic compound  
XRF - X-Ray fluorescence

## Introduction

In accordance with adopted federal EPA regulation, 40 CFR Part 58, Subpart B §58.10<sup>(1)</sup>, the Vermont Air Pollution Control Division is required to submit to EPA by July 1, 2012 an air monitoring network plan for the State of Vermont. The new regulation requires that the plan be posted for public comment 30 days prior to submission to the EPA Region 1 Office.

The current air monitoring network plan will be made available to the public on the APCD's website, <http://www.anr.state.vt.us/air/index.htm> for the 30-day comment period.

Please send all comments regarding Vermont Air Monitoring Network Plan:

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E-mail: [ben.whitney@state.vt.us](mailto:ben.whitney@state.vt.us)

## Vermont Air Monitoring Network Overview

The Vermont Air Pollution Control Division (APCD) regulates air quality to protect public health and the environment. Air monitoring data is required by regulation and is used to determine compliance with the Environmental Protection Agency's (EPA) national ambient air quality standards ([NAAQS](#))<sup>(2)</sup>, and Vermont's hazardous ambient air standards ([HAAS](#))<sup>(3)</sup>. Other important uses of the of air monitoring data includes, the production of a daily Air Quality Index (AQI) report, daily air quality forecast report, support of short and long-term health risk assessments, and tracking long-term trends in air quality.

Air pollution is created by many anthropogenic sources, such as cars, trucks, buses, factories, power plants, as well as, natural sources such as forest fires, volcanoes, and wind storms. The pollution emanating from these sources can be local or transported from great distances. Control strategies and equipment applied to industry greatly reduced the particulate, CO, SO<sub>2</sub>, and NO<sub>2</sub> emitted into the ambient air. The phase-out of leaded gasoline produced reductions in ambient air lead concentrations. New automobiles are now equipped with emission controls and catalytic converters which greatly reduced ambient air concentrations of nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO) and volatile organic compounds (VOC's). Through other regional, national, and global control strategies, pollutants such as ozone and particulate matter concentrations in Vermont are continuing to be reduced. New air pollution control technologies and strategies are expected to provide further reductions of air pollutants in the future.

Ambient air monitoring is valuable activity, which is essential for state environmental planning, enforcement efforts, trends analysis, and more recently providing timely air quality health

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advisories. Air monitoring began in Vermont in the 1960's, with a focus on total suspended particulate (TSP). During the 1970's, monitoring methods improved to allow for a better quality particulate sampling and continuous monitoring of gaseous criteria pollutants such as carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), and ozone (O<sub>3</sub>). During the late 70's and early 80's rapid development of computerized data acquisition systems allowed for collection of air quality data on a near real-time basis. Also during the 1980's, monitoring methods and analytical techniques were developed to assay classes of toxic compounds such as VOC's, PCB's, PAH's, Carbonyls, and Metals. As technology improves, so does the ability to identify and quantify pollutants in both a spatial and temporal manner. Some of the newer technologies allow for real-time monitoring of toxic compounds.

At the current time, the Vermont APCD operates and maintains five permanent air monitoring stations. Vermont established a monitoring network for criteria pollutants in the 1970's and a network for toxic air pollutants in 1985. Currently, the APCD monitors for 6 criteria pollutants and 92 toxic pollutants. All current air monitoring sites meet the federal requirements for site development. The criteria pollutant monitoring methods are EPA compliant as federal reference methods (FRM), or federal equivalent methods (FEM) designated instruments. The current air monitoring network has received tentative approval by EPA New England Region I during the last technical systems audits (TSA). The Quality Assurance Project Plan (QAPP) for the Air Toxics and PM<sub>2.5</sub> monitoring programs has EPA approval. The APCD submitted QAPP update for the Criteria monitoring program. The NCore and Meteorological portions of that QAPP must still be finalized and approved. EPA approval of the Criteria QAPP documents is pending, with expected authorization anticipated by July 2013.

On December 16, 2006, the EPA reduced the daily PM<sub>2.5</sub> (NAAQS) from 65 µg/m<sup>3</sup> to 35 µg/m<sup>3</sup>. The annual PM<sub>2.5</sub> NAAQS remained 15µg/m<sup>3</sup>. Vermont operates a small network of Federal Reference Monitors (FRM) as well as Federal Equivalent Monitors (FEM) for continuous PM<sub>2.5</sub> to assess air quality for PM<sub>2.5</sub>.

During the December 16, 2006 regulation update, it addressed the creation of multi-pollutant National Core Sites (NCore) sites throughout the country. EPA's Office of Air Quality Planning and Standards (OAQPS) approved Vermont's NCore station at Underhill, VT on October 30, 2009. The Underhill site is one of the 20 rural sites within the NCore network. The upgrades to the site required the addition of "trace level" monitoring for Carbon Monoxide (CO), Nitrogen Oxides (NO<sub>x</sub>), and Sulfur Dioxide (SO<sub>2</sub>).

In November 2008, the new national ambient air quality standard (NAAQS) for lead was strengthened to 0.15 micrograms per cubic meter. The primary standard and secondary standard are set at the same level. In April 2011, the EPA issued the final NAAQS lead monitoring requirements for the required monitoring sites. Vermont was not required to set up any NAAQS lead monitors at that time. The reason for this designation is the State of Vermont does not meet the population thresholds for the CBSA's, airports do not meet "take off" & "landing" thresholds, or stationary emission source "tons per year" do not meet required thresholds. The 2009 Vermont Lead (Pb) NAAQS Monitoring Plan provided the current plan and approach that was pursued by the State of Vermont with regard to ambient lead air monitoring network prior to the 2010-2011 monitoring requirement updates. As of January 2010, VT APCD, as part of the

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National Air Toxics Trends Site (NATTS) in Underhill, has conducted low-volume PM<sub>10</sub> sampling with subsequent multi-metals (Pb included) analysis.

The March 27, 2008 8-Hour Ozone NAAQS of 8 hour primary standard of 0.075 parts per million was adopted. Vermont currently is in compliance with this NAAQS standard. EPA Region 1 has recommended that Vermont consider a new ozone monitoring station in the central part of Vermont to better define ozone spatial and temporal occurrence.

On January 22, 2010, the final rule for Nitrogen Dioxide (NO<sub>2</sub>) NAAQS for was adopted. The new NO<sub>2</sub> NAAQS for 1-hour is based on the 3 year average, of the 98<sup>th</sup> percentile, of the 1-hr daily maximum. The 1- hr NAAQS value was set at 100 parts per billion. EPA in cooperation with States/Local/Tribe agencies will set up 40 NO<sub>2</sub> monitors nationwide to help protect communities that are susceptible to NO<sub>2</sub> health effects. Vermont currently will not required by EPA under this new rule to set up any additional NO<sub>2</sub> monitors or require consideration of a “near roadway” site in the network other than what is currently being operated in Burlington and Rutland.

The final rule was signed on June 2, 2010 the new 1 Hour Sulfur Dioxide (SO<sub>2</sub>) NAAQS was adopted. EPA strengthened the primary NAAQS for sulfur dioxide by establishing a new 1 hour standard level set at 0.075 ppm. The new design value form is a three year average of the 99<sup>th</sup> percentile of the annual distribution of the daily maximum 1 hour average concentration for that year. The rule revokes the previous 24 hour standard (140 ppb) and the annual standard (30 ppb). The 2010 State recommended designation design value for Vermont NAAQS SO<sub>2</sub> uses 2008, 2009, and 2010 SO<sub>2</sub> summary data. Vermont currently is not required under the new rule to set up additional SO<sub>2</sub> monitors in the network above and beyond what is currently being operated in Rutland.

### **Network Changes July 2011 to July 2012 Air Monitoring Network Changes**

The Vermont APCD network changes, additions, and deletions that were planned for the 12 month period of July 2011-June 2012 were:

1. Complete changeover of ATEC 300 series VOC & Carbonyl samplers with ATEC 2200 series.
2. Suspension of the high volume PM<sub>10</sub> sampling by December 31, 2011. Sites include Burlington, Rutland, and Underhill.
3. Support development of new NFS Improve site at MT. Snow, West Dover, VT. Manchester site will be retired in Fall 2011
4. Due to a catastrophic flooding from tropical storm Irene on August 2011, the DEC laboratory operations were suspended due to all the damage to the first floor. The VT APCD PM<sub>2.5</sub>/ PM<sub>10</sub> weighing facility, as well as workspace, were totally destroyed by the flooding, thus suspending operations until an alternative workspace and arrangements for laboratory services had been put in place.
5. The PM<sub>2.5</sub> sampling was suspended until such time as samples could be adequately collected and processed within the time-frames set forth in 40 CFR Parts 58 Appendix L.
6. The hi-volume PM<sub>10</sub> sampling was due for termination December 31 and be replaced with low volume or dichotomous PM<sub>2.5</sub>/PM<sub>10</sub> sampling. However to hi-volume effort

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was immediately terminated due to the loss of weighing facility, need to set up contracted weighing for only a short period, and being within a calendar quarter of termination of this type of sampling.

7. USEPA & State of Massachusetts DEP stepped forward to assist Vermont APCD in facilitating PM<sub>2.5</sub> weighing services to Vermont.
8. Starting early June 2012 Vermont APCD switched PM<sub>2.5</sub> weighing services to the EPA contractor RTI. The VT APCD plan is to be weighing filters once again with its own new laboratory facility in Barre, VT, by March 2013.
9. Disruption in certification service for Ozone referencing due to the destruction of the in-house primary standard and two transfer standards. EPA Region 1 has assisted in providing a transfer standard for the work to continue.
10. Over \$500K of equipment was destroyed in DEC laboratory flood. Much of the critical major equipment has been reordered, however rebuilding of a new laboratory space will take time.
11. Two new locations for DEC laboratory chemistry section and APCD TSS have been identified. The DEC laboratory chemistry section has relocated to the Hills Building at the University of Vermont, in Burlington VT. Currently this will most likely be for a three year period. The APCD TSS will be relocated to 322 Industrial Lane, Barre, VT.

### **Proposed Changes July 2012 to July 2013 Air Monitoring Network Changes**

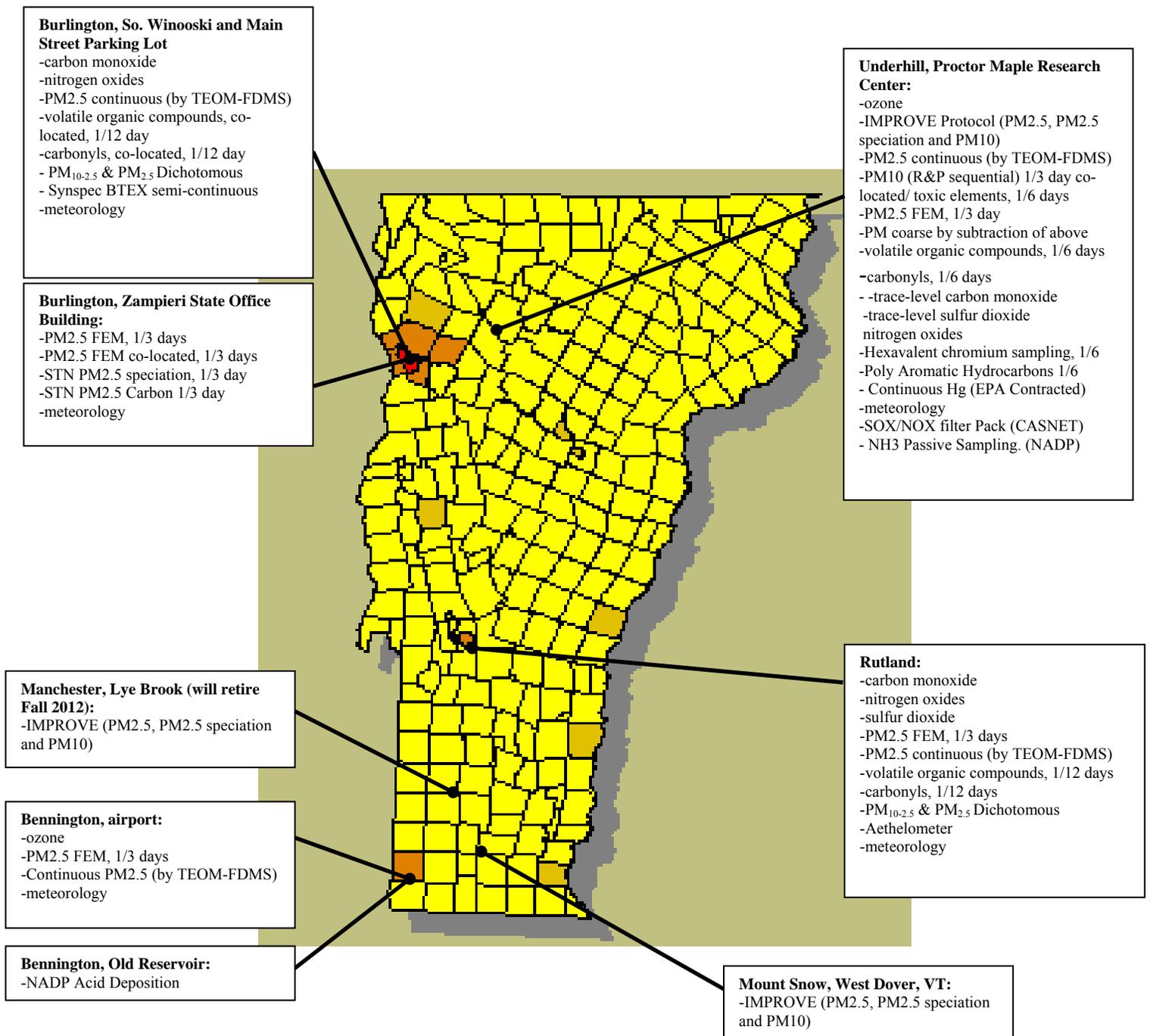
The Vermont APCD network additions that are planned for the next 12 months of July 2012-June 2013 are:

1. Develop new DEC chemistry laboratory in Burlington, VT. Return of in-house analytical services for VOC's, Carbonyls, and metals.
2. Install 2025iD units in Burlington and Rutland.
3. Develop new PM<sub>2.5</sub> weighing facility in Barre, VT. Certify for operation and develop timeline for providing services for regional clients.
4. Deploy new BAM 1020 in Rutland.
5. Replace Rutland Trailer.
6. Replace two 2025 units (Rutland & Bennington)
7. Provide training and update data acquisition systems with Agilaire AirVision software.
8. Network trailer communication and new facility at 322 Industrial Lane, Barre
9. Consider new PM<sub>2.5</sub>/Ozone/Toxics site.
10. Establish Underhill [CASNET SO<sub>x</sub>/NO<sub>x</sub>](#) filter-pack station and passive ammonia monitoring ([AMoN](#)) station, in coordination with EPA & Vermont Monitoring Cooperative (VMC). VCM employee will be responsible for the collection and delivery of all samples to EPA. VT APCD will assist where we can with this project.

**2012 - Monitoring Site Network Map**

**Figure 1 - Vermont Air Monitoring Network Plan Map**

2012 Vermont Ambient Air Monitoring Network



## Network Pollutant Monitoring Descriptions

Below is the list of network pollutant monitoring descriptions with number of sites, the sampling frequency, and specific network information.

### PM<sub>2.5</sub> FRM Monitoring Network

The Vermont APCD operates four PM<sub>2.5</sub> FRM sites. The monitoring locations are in Burlington, Bennington, Rutland and Underhill. The network samplers operate on a 1-in-3 day sampling schedule. The sampling method is an EPA approved method, collecting an integrated 24 hour particulate sample on a 47mm Teflon<sup>®</sup> filter disc (See Table 1). The particulate collected on the filter has an aerodynamic particle size of ≤2.5 microns. The filter and associated sampling data are post processed through gravimetric analysis to determine the mass concentration for the 24 hour sampling period.

**Table 1 - PM<sub>2.5</sub> Sample/Analysis Method**

Pollutant	Sampler	Collection	Analytical Method	Analytes /Lab
PM <sub>2.5</sub>	R&P 2025 Manual Reference Method: EQPM-0202-145	Low Volume 47 mm Teflon <sup>®</sup> Filter - 24 Hour	Gravimetric	PM <sub>2.5</sub> VT DEC

“Design values” for PM<sub>2.5</sub> must be calculated every year for operational sites operating FRM or FEM PM<sub>2.5</sub> samplers. The site must meet the design value statistical definition in order for a design value to be calculated. See below for further information.

### PM<sub>2.5</sub> Annual Design Value (2011)

PM<sub>2.5</sub> annual design values are calculated using the 3-year average of the respective annual averages (See Table 2). The current annual PM<sub>2.5</sub> NAAQS is 15µg/m<sup>3</sup>.

**Table 2- PM<sub>2.5</sub> Annual Design Value**

Site	Design Value (µg/m <sup>3</sup> ) Years 2009-2011
Bennington	6.9*
Burlington	7.3*
Rutland	9.8*
Underhill	5.2*

*\*In August 2011, due to the flood destruction of the DEC Laboratory PM sampling was suspended for a month until Massachusetts DEP was online to accept VT filters for weighing. The 2011 data completeness rates were not met by rule and summaries reflect this condition.*

### PM<sub>2.5</sub> Daily Design Value (2011)

Below are the current daily design values from PM<sub>2.5</sub> for 2010. PM<sub>2.5</sub> daily design values are calculated using the 3-year average of the annual 98<sup>th</sup> percentile values. As of 2006, the new more stringent daily PM<sub>2.5</sub> standard is 35 µg/m<sup>3</sup>. Area PM<sub>2.5</sub> designations relative to the PM<sub>2.5</sub> daily standard were compiled based upon measured PM<sub>2.5</sub> data from 2008-2010. Currently, under the 2006 PM<sub>2.5</sub> NAAQS, all Vermont monitors are in attainment for both the annual and daily PM<sub>2.5</sub> standards.

**Table 3 - PM<sub>2.5</sub> 2011 Daily Design Value**

Site	Design Value (µg/m <sup>3</sup> ) Years 2009-2011
Bennington	19
Burlington	22
Rutland	31
Underhill	16

*\*In August 2011, due to the flood destruction of the DEC Laboratory PM sampling was suspended for a month until Massachusetts DEP was online to accept VT filters for weighing. The 2011 data completeness rates were not met by rule and summaries reflect this condition.*

### PM<sub>2.5</sub> Speciation Monitoring Network

The Vermont APCD operates two PM<sub>2.5</sub> speciation sites (See Table 4). These sites are located at Burlington-Zampiere and Underhill. The samplers operate on a 1-in-3 day schedule and produce a 24 hour integrated filter based sample. Both Underhill and Manchester-Lye Brook are part of the IMPROVE (Interagency Monitoring of Protected Visual Environments) network. The Lye-Brook monitoring site listed in this document is operated and maintained by the National Forest Service and is not part of the Vermont APCD network plan. The Burlington site is part of the EPA Speciation Trends Network (STN).

The analysis of the filters generates data on chemical makeup of PM<sub>2.5</sub>. The method is capable of measuring concentration levels of sulfate, nitrate, ammonium, and trace elements including metals, elemental carbon, and organic carbon. The STN is designed to complement the FRM network. The IMPROVE network monitors are mostly located in rural areas, and provide measurements of regional and background levels of PM<sub>2.5</sub> concentrations. The same chemical components are measured by IMPROVE as are measured by the STN, although differences exist between the methods employed to collect and analyze the collected sample.

In 2009 the STN network deployed the new carbon sampler to enhance the carbon speciation measurement. The sampler operates on the 1/3 day schedule and is collocated with the current Met One SASS sampler.

**Table 4– Speciation Sample/Analysis Method**

<b>Pollutant</b>	<b>Sampler</b>	<b>Collection</b>	<b>Analytical Method</b>	<b>Analytes /Lab</b>
PM Speciation (STN)	Met One - SASS	Low Volume Multi Filter 24 Hour	STN	See Appendix A/RTI
PM Carbon (STN)	URG 3000-N	Low Volume Multi Filter 24 Hour	Carbon Analysis	See Appendix A/RTI
PM Speciation ( IMPROVE)	UCDavis – IMPROVE Sampler	Low Volume Multi Filter - 24 Hour	IMPROVE	See Appendix A/UCDavis

**Continuous PM<sub>2.5</sub> Monitoring Network**

The Vermont APCD operates four continuous PM<sub>2.5</sub> sites (See Table 5). The R&P Model 8500 FDMS TEOM is operated at the Bennington, Burlington, Rutland, and Underhill sites. All continuous PM<sub>2.5</sub> samplers are operated year-round and have a collocated PM<sub>2.5</sub> FRM sampler for comparative analysis. Data is reported to 1-hour and 24-hour averaging periods. The data is currently used for PM<sub>2.5</sub> AQI determination and trends analysis. At this time the VT APCD operates three Thermo Scientific TEOM® 1400a Ambient Particular Monitor with Series 8500C FDMS® and one Thermo Scientific TEOM® 1405-F Single Channel Ambient Particular Monitor with FDMS®.

Based on a July 24, 2008 EPA memo, which provided guidance on the implementation of continuous PM<sub>2.5</sub> sampling approved for federal equivalency, Vermont APCD has chosen at this time not to formally evaluate the approved continuous PM<sub>2.5</sub> sampling method before designating the units as primary NAAQS units at the SLAMS sites. While the 8500C unit has received Federal Equivalency Method approval by EPA, which would allow the units to be used as NAAQS compliance monitor, VT APCD continues to operate these units, evaluating performance based on the collocated FRM samplers. At such time that demonstration of performance has been formally evaluated and approved, VT APCD will notify Region 1 EPA and designate these continuous units as primary monitors if appropriate.

**Table 5 - Continuous PM<sub>2.5</sub> Method**

<b>Pollutant</b>	<b>Sampler</b>	<b>Collection</b>	<b>Analytical Method</b>	<b>Reported Data Interval</b>
PM <sub>2.5</sub>	Thermo Scientific Model 8500 FDMS TEOM	Low Volume Filter/ microbalance	Continuous gravimetric	1 Hour
PM <sub>2.5</sub>	Thermo Scientific Model 1405F FDMS TEOM	Low Volume Filter/ microbalance	Continuous gravimetric	1 Hour

**Black Carbon**

The Magee AE22 Aethalometer measures the optical absorption of carbon particles at two wavelengths: 880 nm (IR), quantitative for the mass of ‘Black’ or Elemental Carbon; and 370 nm (UV). With data processing aromatic organic compounds such as are found in wood smoke, biomass-burning smoke, and tobacco smoke may be identified. Utilizing dual wavelength measurement allows for the determination of the sources of airborne black carbon particles (ie. diesel exhaust vs. wood smoke combustion). Data is store at 1 hour intervals. The unit is currently located in Rutland and has been operational as of February 2009.

**Table 6 – Aethalometer Monitoring Method**

<b>Pollutant</b>	<b>Sampler</b>	<b>Collection</b>	<b>Analytical Method</b>	<b>Reported Data Interval</b>
Black Carbon	Magee AE22	Quartz Filter Tape	Continuous Optical Measurement	1 Hour

**Ozone Monitoring Network**

The Vermont APCD operates two ozone sites in the air monitoring network. Both ozone analyzers are operated year-round. Data is collected on an hourly basis. Ozone measurements are utilized to determine compliance with the 8-hour NAAQS. Data is transferred hourly to the EPA AIRNOW website for AQI mapping and air quality forecasting.

“Design values” for ozone must be calculated every year for sites operating FEM instruments. The site must meet the design value statistical definition in order for a design value to be calculated. See below for further information.

**Table 7 – Ozone Monitoring Method**

<b>Pollutant</b>	<b>Sampler</b>	<b>Collection</b>	<b>Analytical Method</b>	<b>Reported Data Interval</b>
Ozone	API 400 Automated Equivalent Method: EQOA-0992-087	Continuous sampling	Ultraviolet	1 Hour

**Ozone Design Value (2009-2011)**

Below are the current design values for ozone from 2009-2011 (See Table 8). Ozone design values are calculated by taking the 3-year average of the annual 4<sup>th</sup> maximum daily maximum 8-hour ozone averages. The current NAAQS 8-hour ozone standard is 0.075 ppm. Currently, all Vermont monitors are in attainment for ozone.

**Table 8 - Ozone 8 Hour 2011 Design Values**

Site	Design Value (PPM) Years 2009-2011
Bennington	.065
Underhill	.060

**Ambient Air Toxics Monitoring Network**

The Vermont APCD operates three ambient air toxics monitoring sites. The three monitoring sites are located in Burlington, Rutland and Underhill. Samplers at the sites are operated on a 1-in-12 day (Burlington, Rutland) or 1-in-6 day sample schedule (Underhill). The Underhill site is part of the EPA National Air Toxics Trends Stations (NATTS) network.

The air toxic sample collection and analysis program includes volatile organic compounds (VOC), carbonyl compounds, and elemental metals at all sites. In addition, the NATTS - Underhill site includes sampling for hexavalent chromium(Cr<sup>+6</sup>) and Polyaromatic Hydrocarbons (PAH) compounds. In addition to the VOC samples collected at all 3 sites, a Synspec GC955 semi-continuous GC/PID analyzer is operated at the Burlington site to determine 15-minute average concentrations of BTEX compounds. See Table 9 below for the list of sampling methods and analytical methods. The list of target analytes for the sampling methods are listed in [Appendix A](#).

**Table 9- Ambient Air Toxic Sampling/Analysis Methods**

Pollutant	Sampler	Collection	Analytical Method	Analytes/Lab
VOC	ATEC 2200	6 Liter SS Canister-24 Hour	TO-15 (GC/MS)	54 VOC Compounds ERG
Carbonyl	ATEC 2200	DNPH Cartridge-24 Hour	TO-11A (HPLC)	4 Carbonyl Compounds VTDEC and/or VT DEC
Metals (Lead Included)	R&P 2025 PM10 Low-Volume	Teflon Filter-24 Hour	IO-3.5 (ICP/MS)	11 Elements ERG and/or VT DEC
PAH	Tisch TE-1000	PUF/XAD-24 Hour	TO-13 (GC/MS)	22 PAH Compounds ERG
Hexavalent Chromium	VT APCD Cr+6 Sampler (based on ERG design)	Cellulose Filter-24 Hour	Modified CARB 039 (Ion Chromatography)	1 Element ERG
BTEX	Synspec GC955 Series 600	Semi-Continuous 15 Minute	GC-PID	5 VOC Compounds

## PM<sub>10</sub> Monitoring Network

The Vermont APCD operates three PM<sub>10</sub> monitoring sites. The monitoring locations of these sites are Burlington, Rutland and Underhill. The network operates on a 1-in-3 day sampling schedule. The sampling method utilized for sample collection is 24 hour low volume sample collection, on a 47mm Telfon<sup>®</sup> filter (See Table 10 – PM<sub>10</sub> Sample/Analysis Method). The particulate collected on the filter has an aerodynamic particle size of ≤10 microns. The filter and associated sampling data are post processed through gravimetric analysis to determine the mass concentration for the 24 hour sampling period. The gravimetric determination for concentration of PM<sub>10</sub> is completed. The network of high volume samplers were retired in August 2011 due to the loss of the gravimetric lab and the planned retirement of this sampling method.

In Underhill, two collocated low-volume R&P 2025 samplers are configured to collect PM<sub>10</sub>. The sample is collected on a 47mm Teflon<sup>®</sup> filter. Subsequent gravimetric analysis is performed to determine the mass concentration. These filters are subsequently submitted for metals analysis to either EPA’s contract laboratory ERG or the VT DEC laboratory. The metals analysis performed does include the element lead (Pb). This ICP/MS analytical method performed here has yet to receive FEM approval for Lead NAAQS determination by EPA.

**Table 10 – PM<sub>10</sub> Sample/Analysis Method**

Pollutant	Sampler	Collection	Analytical Method	Analytes /Lab
PM <sub>10</sub>	TEI 2029iD Manual Equivalent Method: EQPS-0311-198	Low Volume 47 mm Teflon <sup>®</sup> Filter	Gravimetric	PM <sub>10</sub> VT DEC
PM <sub>10</sub>	R&P 2025 Manual Reference Method: RFPS-1298-127	Low Volume 47 mm Teflon <sup>®</sup> Filter	Gravimetric	PM <sub>10</sub> VT DEC

## Nitrogen Dioxide Monitoring Network

The Vermont APCD operates two nitrogen oxide (NO<sub>x</sub>) analyzers which are presently located at the Burlington and Rutland monitoring sites. Ambient concentrations of both nitrogen dioxide and nitric oxide are determined by this continuous chemiluminescence method (See Table 11 – Nitrogen Dioxide Monitoring Method) The NO<sub>x</sub> samplers are operated year-round. Underhill NCore monitoring commenced fall of 2010 which includes NO<sub>y</sub> trace level monitoring.

**Table 11– Nitrogen Dioxide Monitoring Method**

Pollutant	Sampler	Collection	Analytical Method	Reported Data Interval
Nitrogen Dioxide/Nitric Oxide	TEI 42C Automated Reference Method: RFNA-1289-074	Continuous sampling	Chemiluminescence	1 Hour
NO <sub>y</sub> (TL)	Ecotech EC9841T Automated Reference Method: RFNA-1292-090	Continuous sampling	Chemiluminescence	1 Hour

## Nitrogen Dioxide Design Value (2011)

Below are the current calculated 1-Hr & Annual design values for Nitrogen Dioxide from 2009-2011 (See Table 12 & 13). Nitrogen Dioxide design values are calculated by taking the 3-year average of the 98<sup>th</sup> percentile daily maximum 1-hour nitrogen dioxide averages. The current 1-hour nitrogen NAAQS standard is 100 parts per billion. The current annual NAAQS NO<sub>2</sub> standard is 53 parts per billion. The annual average is simply the average of all annual 1 hr averages. Currently, all Vermont monitors are in attainment for nitrogen.

**Table 12 – Nitrogen Dioxide 2011 1- Hr Design Values**

Site	Design Value (PPB) Years 2009-2011
Burlington	39
Rutland	41

**Table 13 – Nitrogen Dioxide 2010 Annual Average Design Values**

Site	2011 Design Value (PPB)
Burlington	8
Rutland	7

## Carbon Monoxide Monitoring Network

The Vermont APCD operates two CO analyzers located at the Burlington and Rutland monitoring sites. The CO samplers are operated year-round. CO concentrations are determined by a continuous infra-red method (See Table 14 – Carbon Monoxide Monitoring Method). In the fall of 2010, trace-level (TL) carbon monoxide will be monitored in Underhill.

The current national primary ambient air quality standards for carbon monoxide are as follows:

9 parts per million for an 8-hour average concentration not to be exceeded more than once per year and 35 parts per million for a 1-hour average concentration not to be exceeded more than once per year.

**Table 14– Carbon Monoxide Monitoring Method**

Pollutant	Sampler	Collection	Analytical Method	Reported Data Interval
Carbon Monoxide	TEI 48C Automated Reference Method: <b>RFCA-0981-054</b>	Continuous sampling	Infra-red	1 Hour
Carbon Monoxide (TL)	Ecotech EC9830 Automated Reference Method: <b>RFCA-0992-088</b>	Continuous sampling	Infra-red	1 Hour

**Table 15 – Carbon Monoxide Design Value 2011**

Site	2011 Design Value (CO PPM)
Burlington CO -1 Hour	1.7
Burlington CO -8 Hour	1.2
Rutland CO -1 Hour	2.2
Rutland CO -8 Hour	1.7
Underhill CO -1 Hour	0.44
Underhill CO -8 Hour	0.4

**Sulfur Dioxide Monitoring Network**

The Vermont APCD operates one sulfur dioxide (SO<sub>2</sub>) analyzer, located at the Rutland monitoring site. The SO<sub>2</sub> sampler is operated year-round. SO<sub>2</sub> concentrations are determined by a continuous pulsed fluorescence method (See Table 16– Sulfur Dioxide Monitoring Method). The proposed plan calls for the startup of trace level SO<sub>2</sub> in Underhill by fall 2010.

The level of the national primary 1-hour annual ambient air quality standard for oxides of sulfur is 75 parts per billion, measured in the ambient air as sulfur dioxide (SO<sub>2</sub>). The 24 hour air quality standard for oxides of sulfur is 0.140 parts per million and the annual air quality standard for oxides of sulfur 0.030 parts per million.

The 1-hour primary standard is met at an ambient air quality monitoring site when the three-year average of the annual (99th percentile) of the daily maximum 1-hour average concentrations is less than or equal to 75 ppb, as determined in accordance with 40 CFR Part 50 Appendix T.

**Table 16– Sulfur Dioxide Monitoring Method**

Pollutant	Sampler	Collection	Analytical Method	Reported Data Interval
Sulfur Dioxide	TEI 43C Automated Equivalent Method: <b>EQSA-0486-060</b>	Continuous sampling	Pulsed Fluorescence	1 Hour
Sulfur Dioxide (TL)	TEI 43C – TL Automated Equivalent Method: <b>EQSA-0486-060</b>	Continuous sampling	Pulsed Fluorescence	1 Hour

**Table 17 – Sulfur Dioxide Design Values 2011**

Site	Design Values (SO <sub>2</sub> PPB) Years 2009-2011 utilized for 1 Hour
Rutland – 1 Hour	26.7
Underhill – 1 Hour	6.3

## Monitoring Site Parameter Information

Below in Table 16 is a list of all of the monitoring sites and parameters currently or proposed to be operated by the State of Vermont or National Forest Service. The monitoring sites are listed in alphabetical order by site name.

**Table 18 - Network Pollutant Monitoring By Location**

		Carbon Monoxide	Nitrogen Dioxide	Ozone	Sulfur Dioxide	Speciation (STN / IMPROVE)	BTEX	PM <sub>2.5</sub> FRM	PM <sub>2.5</sub> TEOM	PM <sub>10</sub> FRM	PM <sub>10</sub> Low Volume	VOC	Carbonyl	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Rain Fall	Pressure	PAH	
Bennington	Airport Road			✓				✓	✓						✓	✓	✓	✓	✓	✓	✓		
Burlington	150 So Winooski Ave	✓	✓				✓		✓	x	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Burlington	108 Cherry Street					✓		✓							✓	✓	✓	✓	✓	✓	✓		
Dover	Mount Snow					✓																	
Rutland	Merchants Row	✓	✓		✓			✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Underhill	Harvey Road	✓	✓	✓	✓	✓		✓	✓	x	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓

P=Proposed T=Trace Level x= Hi Volume PM<sub>10</sub> samplers were be remove 4<sup>th</sup> quarter 2011.

**Site Description: Burlington - 150 South Winooski Ave.**

Town – Site **Burlington – South Winooski Ave**  
County: **Chittenden** Latitude: **+44.476200**  
Address: **150 S. Winooski Ave.** Longitude: **-73.210600**  
AQS Site ID: **50-007-0014** Elevation: **63.1 m**  
Spatial Scale: **Urban and City Center** Year Established: **2003**  
Statistical Area: **Burlington-South Burlington, VT Metropolitan**  
**Burlington-South Burlington, VT Metropolitan NECTA**

Location	Site	Carbon Monoxide	Nitrogen Dioxide	Ozone	Sulfur Dioxide	Speciation (STN)	BTEX	PM <sub>2.5</sub> FEM	PM <sub>2.5</sub> TEOM	PM <sub>10</sub> FRM (collo)	PM <sub>10-2.5</sub> Low Volume FEM	VOC (collocated)	Carbonyl (collocated)	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Rain Fall	Pressure
Burlington	150 S. Winooski	✓	✓				✓	✓	✓	X	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

**Site Description:**

This site is located in a municipal parking lot of downtown Burlington, VT, located 1 km east of Lake Champlain, 1.5 km south west of McNeil Generating Station, 2 km west of I-89, and 8 km west of the Essex IBM plant. This site is designated to represent middle and neighborhood-scale. The monitoring location meets all siting requirements and criteria and has been approved by VTAPCD and EPA Region 1.

**General Monitoring Description & Objectives:**

The Burlington monitoring site objective for the CO & NO<sub>2</sub> measurements is compliance and trends purposes. Historically, CO and NO<sub>2</sub> measurements at this site are well below the NAAQS. Monitoring for CO and NO<sub>2</sub> at this site continues to be operated into the future primarily for trends analysis. The objective of the PM<sub>10</sub> monitoring is collect PM<sub>10</sub> for trends analysis. The monitoring objective for the VOC and Carbonyl sample collection and analysis is to assess long-term population exposure on a neighborhood scale, comparison to applicable state standards and trend assessment. Continuous PM<sub>2.5</sub> is used for AQI determination and air quality forecasting. WS/WD & Temp/RH data is collected from a 3.0 meter tower.

**Plans/History:**

- Site established in 2003
- Fall 2012 replace Wedding PM10 collocated samplers with 2025i Dichotomous sampler.

Figure 2 - Burlington Aerial Photo

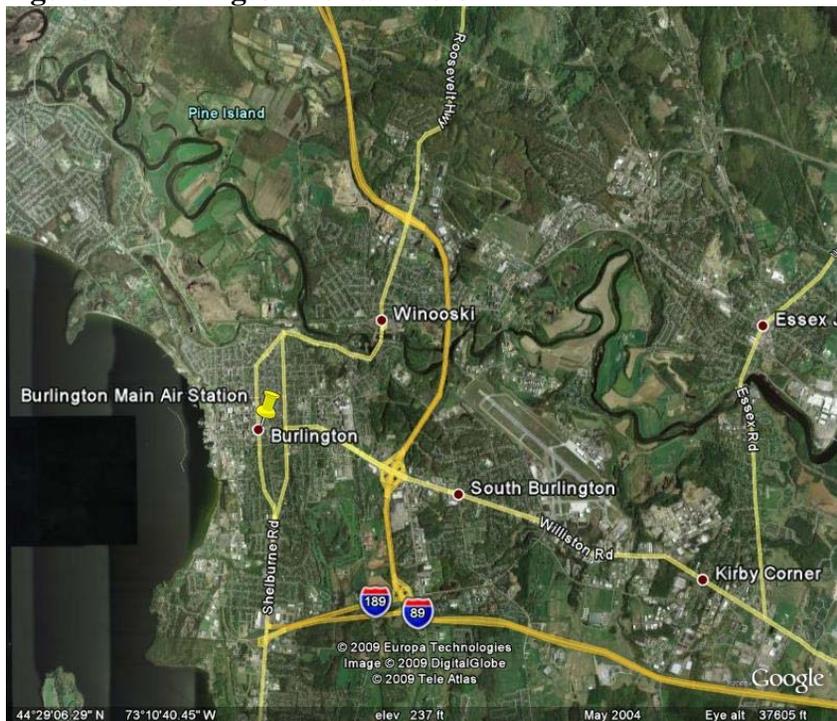
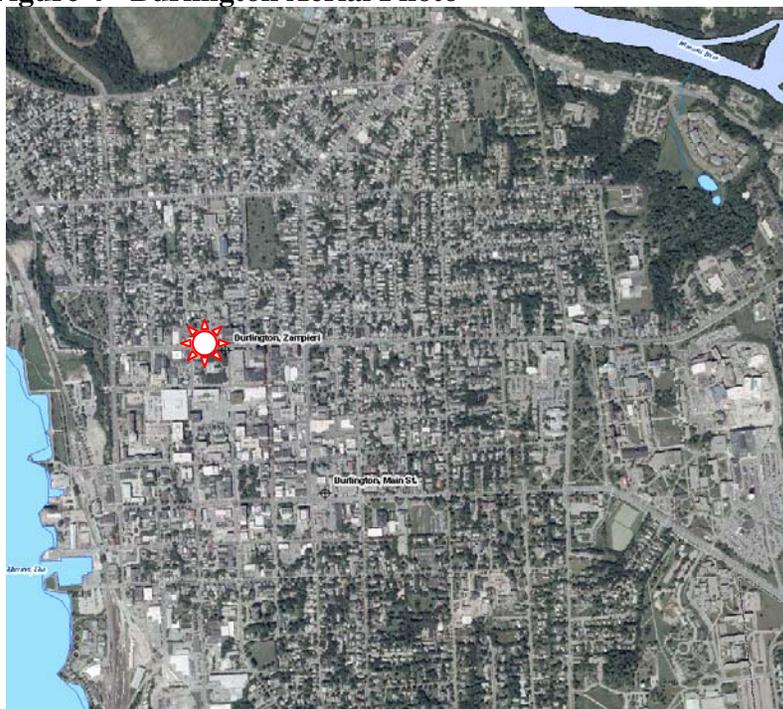


Figure 3 - Burlington Monitoring Shelter





**Figure 4 - Burlington Aerial Photo**



**Figure 5 - Zampieri Building Sampling Platform**

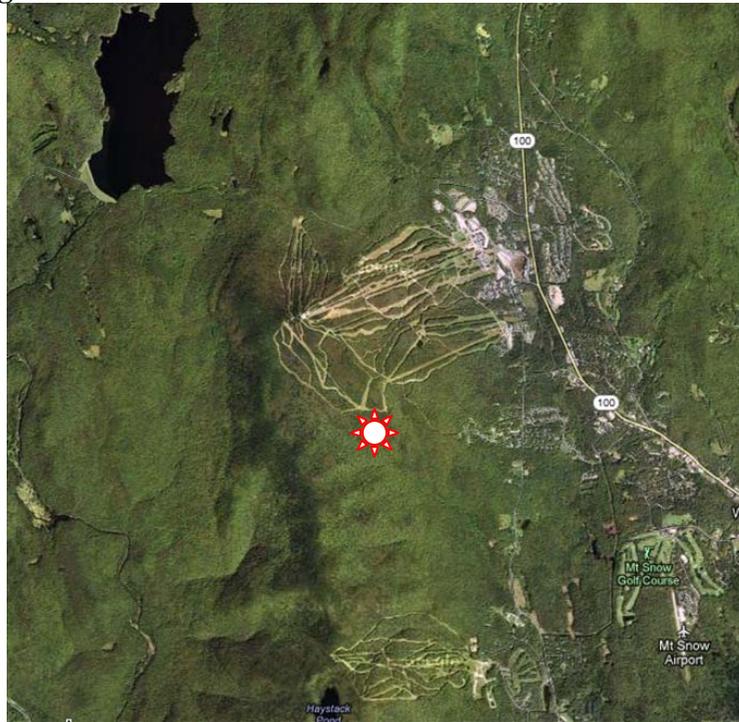


Site Description: **Lye Brook - West Dover – Mount Snow**

Town – Site           **West Dover – Mount Snow – Near Lye Brook Class 1 Area**  
County:               **Bennington**                           Latitude: + **42°57'11.41 N**  
Address:              **Mount Snow**                           Longitude: - **72° 54' 36.72 W**  
Site ID:               **LYEB1**                               Elevation: **1093 m**  
Spatial Scale:       **Rural**                               Year Established:   **2011**  
Statistical Area:    **Bennington, VT Micropolitan Area**

Location	Site	Carbon Monoxide	Nitrogen Dioxide	Ozone	Sulfur Dioxide	Speciation (STN)	Speciation (IMPROVE)	PM <sub>2.5</sub> FRM	PM <sub>2.5</sub> TEOM	PM <sub>10</sub> FRM	PM <sub>10</sub> Low Volume	VOC	Carbonyl	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Rain Fall	Pressure	
West Dove	Mount Snow						✓															
<p><b>Site Description:</b>  <i>This monitoring location is not part of the Vermont APCD monitoring network. The NFS site participates in the IMPROVE network and is included here because it represents a permanent monitoring station within Vermont.</i>  This site is located on the northern slope of Mount Snow. This site is operated and maintained by the National Forest Service. Further information about the Lye Brook site can be seen at <a href="http://vista.cira.colostate.edu/views/Web/SiteBrowser/SiteBrowser.aspx">http://vista.cira.colostate.edu/views/Web/SiteBrowser/SiteBrowser.aspx</a> . The site is identified in the data search as LYEB1. The current data from this site is not accessible from the EPA AQS system.</p>																						
<p><b>General Monitoring Description &amp; Objectives:</b>  This site was established to monitor pollutants that contribute to regional haze impact on the visual environment within the Class 1 Area - Lye Brook Wilderness.</p>																						
<p><b>Plans/History:</b></p> <ul style="list-style-type: none"> <li>Site established 2011</li> </ul>																						

**Figure 6 - Aerial View Mount Snow**



**Figure 7 - View of Monitor Location**



Site Description: **Manchester – Lye Brook Wilderness (Will be retired October 2012)**

Town – Site           **Manchester – Lye Brook**  
County:               **Bennington**                   Latitude:               **+43.1482**  
Address:              **Lye Brook Wilderness**       Longitude:             **-73.1268**  
Site ID:               **LYBR1**                               Elevation:            **1015 m**  
Spatial Scale:       **Rural**                               Year Established:   **1991**  
Statistical Area:    **Bennington, VT Micropolitan Area**

Location	Site	Carbon Monoxide	Nitrogen Dioxide	Ozone	Sulfur Dioxide	Speciation (STN)	Speciation (IMPROVE)	PM <sub>2.5</sub> FRM	PM <sub>2.5</sub> TEOM	PM <sub>10</sub> FRM	PM <sub>10</sub> Low Volume	VOC	Carbonyl	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Rain Fall	Pressure	
Manchester	Mountain Rd.						✓															

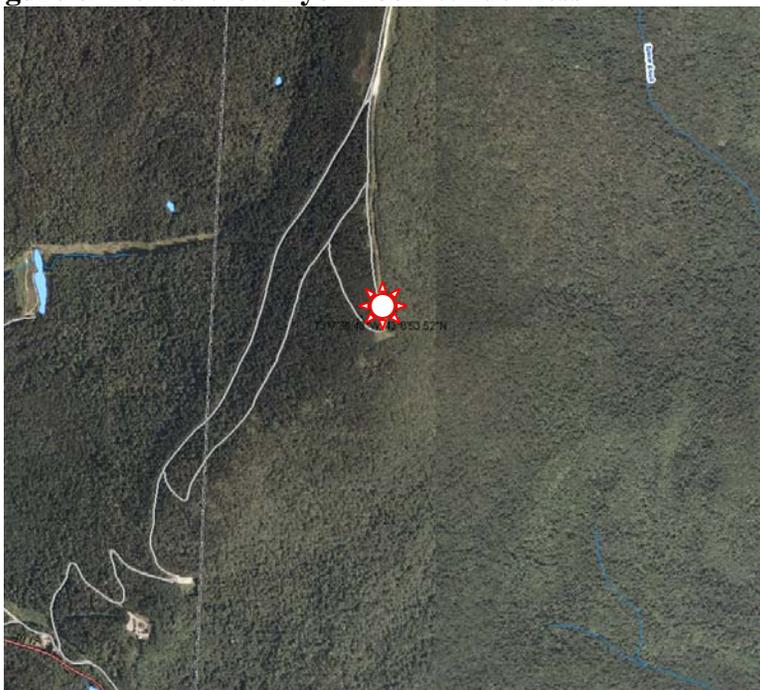
**Site Description:**  
***This monitoring location is not part of the Vermont APCD monitoring network. The NFS site participates in the IMPROVE network and is included here because it represents a permanent monitoring station within Vermont.***  
This site is located at the eastern slope of Mount Equinox. This site is operated and maintained by the National Forest Service. Further information about the Lye Brook site can be seen at <http://vista.cira.colostate.edu/views/Web/SiteBrowser/SiteBrowser.aspx>. The site is identified in the data search as LYBR1. The current data from this site is not accessible from the EPA AQS system.

**General Monitoring Description & Objectives:**  
This site was established to monitor pollutants that contribute to regional haze impact on the visual environment within the Class 1 Area - Lye Brook Wilderness.

**Plans/History:**

- Site established 1991

**Figure 8- Aerial View Lye Brook Wilderness**



**Figure 9 - View of Monitor Location**



**Site Description: Bennington – Airport Road**

Town – Site            **Bennington – Airport Rd.**  
County:                **Bennington**                      Latitude:        **+42.887590**  
Address:               **Airport Rd.**                              Longitude:      **-73.249840**  
AQS Site ID:         **50-003-0004**                            Elevation:       **241 m**  
Spatial Scale:        **Rural**                                        Year Established:    **1986**  
Statistical Area:     **Bennington, VT Micropolitan Area**  
                              **Bennington, VT Micropolitan NECTA**

Location	Site	Carbon Monoxide	Nitrogen Dioxide	Ozone	Sulfur Dioxide	Speciation (STN)	Speciation (IMPROVE)	PM <sub>2.5</sub> FRM	PM <sub>2.5</sub> TEOM	PM <sub>10</sub> FRM	PM <sub>10</sub> Low Volume	VOC	Carbonyl	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Rain Fall	Pressure
Bennington	Airport Road			✓				✓	✓						✓	✓	✓	✓	✓	✓	✓

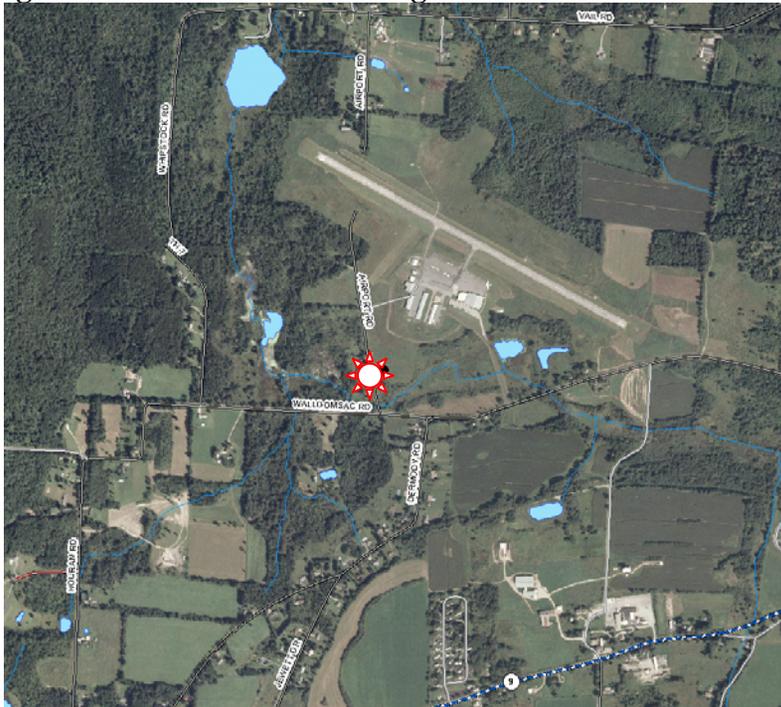
**Site Description:**  
This site is located in a field at rural western end of Bennington, .25 km south west of the Morse Airport, 4.5 km west of the center of Bennington, 1 km north of Route 9, 4 km west of Route 7, 50 km east of Albany, NY. This monitoring location meets all siting requirements and criteria and has been approved by VTAPCD and EPA Region 1

**General Monitoring Description & Objectives:**  
This monitoring objective for O<sub>3</sub> and PM<sub>2.5</sub> FRM is compliance and trends analysis. The site represents a background / transport site with regional scale of exposure. The O<sub>3</sub> and continuous PM<sub>2.5</sub> data are utilized for AQI and air quality forecasting. WS/WD & Temp/RH data is collected from a 10.0 meter tower.

**Plans/History:**

- Site Established 1986

**Figure 10 - Aerial View Bennington**

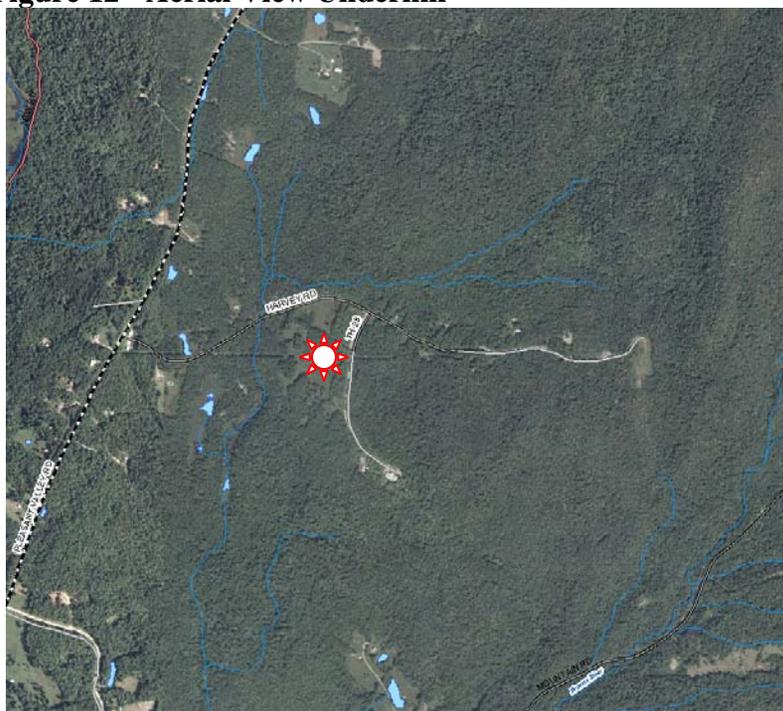


**Figure 11 - Bennington Trailer**





**Figure 12 - Aerial View Underhill**

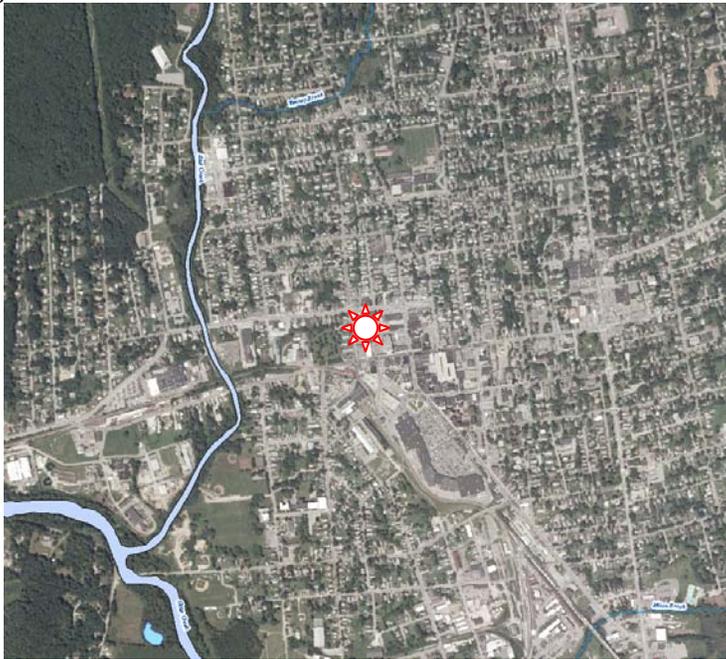


**Figure 13 - Underhill Sampling Deck & Trailer**





**Figure 14 - Aerial View Rutland**



**Figure 15 - Rutland Trailer**



## **Appendix A – List of Analytes for Analytical Methods**

**Table 19 – Elemental Metals Analytes for PM<sub>10</sub> (47 mm Teflon;ERG:2012)**

<b>Metal</b>	<b>MDL (ng/m<sup>3</sup>)*</b>	<b>Metal</b>	<b>MDL (ng/m<sup>3</sup>)*</b>
<b>Antimony</b>	0.282	<b>Lead</b>	0.0729
<b>Arsenic</b>	0.171	<b>Manganese</b>	0.317
<b>Beryllium</b>	0.0159	<b>Mercury</b>	0.0464
<b>Cadmium</b>	0.0123	<b>Nickel</b>	0.402
<b>Chromium</b>	24.2	<b>Selenium</b>	0.346
<b>Cobalt</b>	0.0333	<b>Chromium<sup>+6**</sup></b>	0.0034

\* ERG analysis; assumes 24.04 m<sup>3</sup> except for \*\* Cr<sup>+6</sup> TSP Method CARB 039 assumes 21.6m<sup>3</sup>

**Table 20 – List of Analytes for Speciation Sampling**

<b>Analysis</b>	<b>Analytes</b>	<b>MDL</b>
<b>Gravimetric</b>	<b>Mass</b>	<b>300 ng/m<sup>3</sup></b>
<b>HIPS</b>	<b>Optical Absorption</b>	<b>0.2 Mm<sup>-1</sup></b>
<b>XRF</b>	<b>Elements Fe to Pb</b>	<b>0.05 - 0.18 ng/m<sup>3</sup></b>
<b>PIXE</b>	<b>Elements S to Mn</b>	<b>1 - 4 ng/m<sup>3</sup></b>
	<b>Element Na</b>	<b>20 ng/m<sup>3</sup></b>
<b>PESA</b>	<b>Elemental H</b>	<b>4 ng/m<sup>3</sup></b>
<b>IC</b>	<b>NO<sub>3</sub>, SO<sub>4</sub>, NH<sub>4</sub></b>	<b>10 - 30 ng/m<sup>3</sup></b>
	<b>NO<sub>2</sub>, Cl</b>	<b>60 - 100 ng/m<sup>3</sup></b>
<b>TOR</b>	<b>Organic Carbon</b>	<b>250 ng/m<sup>3</sup></b>
	<b>Elemental Carbon</b>	<b>100 ng/m<sup>3</sup></b>

**Table 21- List of Carbonyl Analytes (2011-2012)**

<b>Carbonyl Compound</b>	<b>VT DEC MDL (µg/m<sup>3</sup>)*</b>	<b>ERG MDL (µg/m<sup>3</sup>)**</b>
<b>Formaldehyde</b>	<b>0.025</b>	<b>0.010</b>
<b>Acetaldehyde</b>	<b>0.011</b>	<b>0.011</b>
<b>Acetone</b>	<b>0.021</b>	<b>0.020</b>
<b>Propionaldehyde</b>	<b>0.004</b>	<b>0.007</b>

\*: assumes 1.294m<sup>3</sup> total sample volume \*\*: assumes 1000 L total sample volume

**Table 22 - Analyte List for VOC Analysis (ERG:2011)**

VOC Compound	MDL ( $\mu\text{g}/\text{m}^3$ )
1,1,1-Trichloroethane	0.112
1,1,2,2-Tetrachloroethane	0.127
1,1,2-Trichloroethane	0.114
1,1-Dichloroethane	0.062
1,1-Dichloroethene	0.057
1,2,4-Trichlorobenzene	0.165
1,2,4-Trimethylbenzene	0.123
1,2-Dibromoethane	0.128
1,2-Dichloroethane	0.064
1,2-Dichloropropane	0.086
1,3,5-Trimethylbenzene	0.109
1,3-Butadiene	0.023
Acrolein	0.137
Acrylonitrile	0.043
Benzene	0.196
Bromochloromethane	0.076
Bromodichloromethane	0.143
Bromoform	0.203
Bromomethane	0.049
Carbon Tetrachloride	0.154
Chlorobenzene	0.117
Chloroethane	0.045
Chloroform	0.067
Chloromethane	0.068
Chloroprene	0.045
cis-1,2-Dichloroethylene	0.073
cis-1,3-Dichloropropene	0.070
Dibromochloromethane	0.155

Note: 3-chloropropene, chloromethylbenzene and methyl ethyl ketone have been removed from this table as they are not on ERG's VOC target list

Dichlorodifluoromethane	0.116
Dichlorotetrafluoroethane	0.082
Ethyl Acrylate	0.056
Ethyl tert-Butyl Ether	0.045
Ethylbenzene	0.101
Hexachloro-1,3-butadiene	0.235
m,p-Xylene	0.159
m-Dichlorobenzene	0.144
Methyl Isobutyl Ketone	0.063
Methyl Methacrylate	0.104
Methyl tert-Butyl Ether	0.040
Methylene Chloride	0.080
n-Octane	0.092
o-Dichlorobenzene	0.127
o-Xylene	0.086
p- Dichlorobenzene	0.117
Styrene	0.100
tert-Amyl Methyl Ether	0.067
Tetrachloroethylene	0.135
Toluene	0.169
trans-1,2-Dichloroethy...	0.048
trans-1,3-Dichloropropene	0.066
Trichloroethylene	0.118
Trichlorofluoromethane	0.083
Trichlorotrifluoroethane	0.127
Vinyl Chloride	0.028

\*EPA is continuing to evaluate analytical method for this compound.

**Table 23 - Analyte List for PAH Analysis (ERG: 2009)**

<b>PAH Compounds</b>	<b>ng/m<sup>3</sup></b>
Naphthalene	0.14
Acenaphthylene	0.026
Acenaphthene	0.038
Fluorene	0.036
9-Fluorenone	0.044
Fluoranthene	0.068
Pyrene	0.067
Phenanthrene	0.034
Anthracene	0.034
Retene	0.122
Benz(a)anthracene	0.042
Cyclopenta(c,d)pyrene	0.065
Chrysene	0.039
Benzo(b)fluoranthene	0.039
Benzo(k)fluoranthene	0.051
Benzo(e)pyrene	0.047
Benzo(a)pyrene	0.052
Perylene	0.052
Indeno(1,2,3-cd)pyrene	0.051
Dibenz(a,h)anthracene	0.044
Benzo(g,h,i)perylene	0.044
Coronene	0.049

## Appendix B – National Ambient Air Quality Standards As of October 2011

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
<a href="#">Carbon Monoxide</a> [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
<a href="#">Lead</a> [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3 month average	0.15 µg/m <sup>3</sup> <sup>(1)</sup>	Not to be exceeded
<a href="#">Nitrogen Dioxide</a> [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		primary and secondary	Annual	53 ppb <sup>(2)</sup>	Annual Mean
<a href="#">Ozone</a> [73 FR 16436, Mar 27, 2008]		primary and secondary	8-hour	0.075 ppm <sup>(3)</sup>	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
<a href="#">Particle Pollution</a> [71 FR 61144, Oct 17, 2006]	PM <sub>2.5</sub>	primary and secondary	Annual	15 µg/m <sup>3</sup>	annual mean, averaged over 3 years
			24-hour	35 µg/m <sup>3</sup>	98th percentile, averaged over 3 years
	PM <sub>10</sub>	primary and secondary	24-hour	150 µg/m <sup>3</sup>	Not to be exceeded more than once per year on average over 3 years
<a href="#">Sulfur Dioxide</a> [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		primary	1-hour	75 ppb <sup>(4)</sup>	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

(1) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m<sup>3</sup> as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

(2) The official level of the annual NO<sub>2</sub> standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(3) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

(4) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO<sub>2</sub> standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

## References

1. Electronic Code of Federal Regulations (e-CFR) Part [58 Subpart B § 58.10](#)
2. United States Environmental Protection Agency Air and Radiation - National Ambient Air Quality Standards (NAAQS) March 2, 2007 <http://epa.gov/air/criteria.html>
3. State of Vermont, Agency of Natural Resources, *Air Pollution Control Regulation; Appendix C*, April 27, 2007 <http://www.anr.state.vt.us/air/docs/apcregs.pdf>
4. United States Environmental Protection Agency, Technology Transfer Network, Ambient Monitoring Technology Information Center – *List of Designated EPA Reference and Equivalent Methods* May 16, 2007 <http://www.epa.gov/ttn/amtic/criteria.html>
5. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 50, Protection of Environment, June 24, 2011.](#)
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