

Vermont Annual Air Monitoring Network Plan 2013



Vermont Department of Environmental Conservation
Air Quality & Climate Division
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Acronyms and Abbreviations

AMTIC - Ambient Monitoring Technical Information Center
AQCD - (Vermont) Air Quality & Climate 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
NO₂ - Nitrogen Dioxide
O₃ - Ozone
OAQPS - Office of Air Quality Planning and Standards
PIXE - Proton Induced X-ray Emission
PMSA - primary metropolitan statistical area
PM₁₀ - Particulate ≤10 micron aerodynamic particle size
PM_{2.5} - 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
SO₂ - 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 AQCD
VOC - volatile organic compound
XRF - X-Ray fluorescence

Introduction

In accordance with adopted federal EPA regulation, 40 CFR Part 58, Subpart B §58.10⁽¹⁾, the Vermont Air Quality & Climate Division is required to submit to EPA by July 1, 2013 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 AQCD'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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Vermont Air Monitoring Network Overview

The Vermont Air Quality & Climate Division (AQCD) 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](#))⁽²⁾, and Vermont's hazardous ambient air standards ([HAAS](#))⁽³⁾. 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, SO₂, and NO₂ 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 (NO₂), 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

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 (SO₂), nitrogen dioxide (NO₂), and ozone (O₃). 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 AQCD 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 AQCD 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 State of Vermont AQCD air monitoring network has received approval by EPA New England Region I during the systems audits (TSA). A number of minor network issues exist that must be addressed in 2013-2014.

The Quality Assurance Project Plans (QAPP) and Standard Operating Procedures supporting the QAPPS are written as documentation as specific EPA grant requirements. These documents are revised annually and an annual review letter for the review of those documents is submitted by the AQCD on November 1st each year. QAPPS and SOP's for Air Toxics and PM_{2.5} monitoring programs have received EPA approval. The AQCD QAPP & SOP updates for the Criteria monitoring program are still pending. The NCore and Meteorological QAPP must still be finalized and approved. EPA approval of the current Criteria QAPP documents is pending outstanding SOP submittals and document changes.

On December 16, 2006, the EPA reduced the daily PM_{2.5} (NAAQS) from 65 µg/m³ to 35 µg/m³. The annual PM_{2.5} NAAQS remained 15µg/m³. Vermont operates a small network of Federal Reference Monitors (FRM) as well as Federal Equivalent Monitors (FEM) for continuous PM_{2.5} to assess air quality for PM_{2.5}.

On Dec 12, 2012 the EPA set the PM_{2.5} "Primary" Annual PM_{2.5} standard to 12 ug/m³ with the "Secondary set at 15 ug/m³. This annual PM_{2.5} average will be computed as the average of the last of a three year period. As an example: The average for 2012 would be the annual averages from 2010,2011, and 2012.

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_x), and Sulfur Dioxide (SO₂).

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 2012, 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 2010-2012 monitoring requirement updates. As of January 2010, VT AQCD, as part of the National Air Toxics Trends Site (NATTS) in Underhill, has conducted low-volume PM₁₀ 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 (NO₂) NAAQS for was adopted. The new NO₂ NAAQS for 1-hour is based on the 3 year average, of the 98th 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 NO₂ monitors nationwide to help protect communities that are susceptible to NO₂ health effects. EPA does not anticipate any requires affecting Vermont. Vermont currently is not be required by EPA under this rule to set up any additional NO₂ monitors or require consideration of a “near roadway” site in the network other than what is currently being operated in Burlington and Rutland or elsewhere in the state of Vermont.

The final rule was signed on June 2, 2010 the new 1 Hour Sulfur Dioxide (SO₂) 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 99th 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 SO₂ uses 2008, 2009, and 2010 SO₂ summary data. Vermont currently is not required under the new rule to set up additional SO₂ monitors in the network above and beyond what is currently being operated in Rutland. EPA has initiated a stakeholder process to refine the implementation the SO₂ monitoring and modeling requirements. The outcome of this process may require greater reliance on new or existing SO₂ monitoring.

Network Changes July 2012 to July 2013 Air Monitoring Network Changes

The Vermont AQCD network changes, additions, and deletions that were planned for the 12 month period of July 2012-June 2013 were:

1. Develop new DEC chemistry laboratory in Burlington, VT. Return of in-house analytical services for VOC's, Carbonyls, and metals
2. Develop new PM_{2.5} weighing facility in Berlin, VT. Certify for operation and develop timeline for providing services for regional clients.
3. Conclude hexavalent chromium sampling for Underhill NAATS site.
4. Replace Rutland Trailer.
5. Replace two 2025 units (Rutland & Bennington)
6. Provide training and update data acquisition systems with Agilair AirVision software.
7. Network trailer communication and new facility at 322 Industrial Lane, Berlin
8. Consider new PM_{2.5}/Ozone/Toxics site.
9. Establish Underhill [CASNET SO_x/NO_x](#) 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 AQCD will assist where we can with this project.

Proposed Changes July 2013 to July 2014 Air Monitoring Network

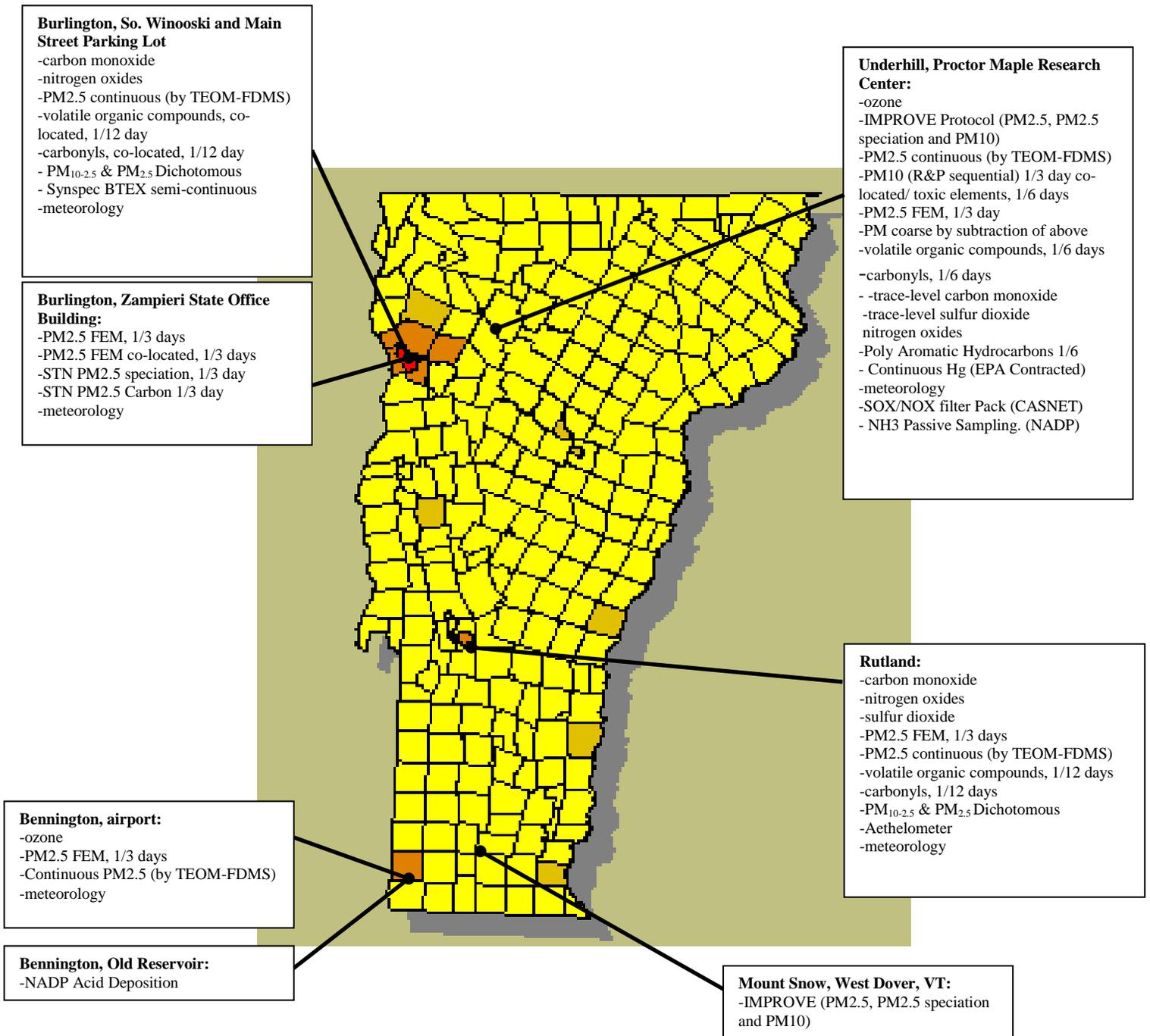
The Vermont AQCD network additions that are planned for the next 12 months of July `2013-June 2013 are:

1. Switch data acquisition to new AirVision August 2013
2. Install new Rutland Trailer – August 2013
3. Provide EPA with assessment of FEM continuous versus FRM historical PM_{2.5} comparison data. Decision of use for FEM continuous PM_{2.5} samplers for NAAQS determinations will be provided.
4. Terminate Hexavalent Chromium sampling in Underhill – NATTS July 2013
5. Re-establish PM_{2.5} weighing services August 2013
6. Rebuild Underhill platform – Sept 2013
7. Reestablish TO-11A analytical work with DEC Laboratory in Burlington, VT
8. Reestablish TO-15 analytical work with DEC Laboratory in Burlington, VT
9. Develop IO 3.5 analytical plan for low-volume PM10 (Underhill, Burlington, Rutland).
10. Work with DEC laboratory advisory group to formulate long term plan for DEC laboratory services.
11. New roof on Burlington Zampieri building and samplers must shut down for 3-6 days in July or August. Flagging of samples during 6 week period of project.
12. Development of new AQCD real-time website to accommodate new data format of Air Vision.
13. Improve Air Quality alert system on AQCD website.

2013 - Monitoring Site Network Map

Figure 1 - Vermont Air Monitoring Network Plan Map

2013 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_{2.5} FRM Monitoring Network

The Vermont AQCD operates four PM_{2.5} 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[®] 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_{2.5} Sample/Analysis Method

Pollutant	Sampler	Collection	Analytical Method	Analytes /Lab
PM _{2.5}	R&P 2025 Manual Reference Method: EQPM-0202-145	Low Volume 47 mm Teflon [®] Filter - 24 Hour	Gravimetric	PM _{2.5} VT DEC

“Design values” for PM_{2.5} must be calculated every year for operational sites operating FRM or FEM PM_{2.5} 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_{2.5} Annual Design Value (2012)

PM_{2.5} annual design values are calculated using the 3-year average of the respective annual averages (See Table 2). The current annual PM_{2.5} NAAQS is 15µg/m³.

Table 2- PM_{2.5} Annual Design Value

Site	Design Value (µg/m ³) Years 2010-2012
Bennington	7.0*
Burlington	7.2*
Rutland	9.6*
Underhill	5.1*

**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_{2.5} Daily Design Value (2012)

Below are the current daily design values from PM_{2.5} for 2012. PM_{2.5} daily design values are calculated using the 3-year average of the annual 98th percentile values. As of 2006, the new more stringent daily PM_{2.5} standard is 35 µg/m³. Area PM_{2.5} designations relative to the PM_{2.5} daily standard were compiled based upon measured PM_{2.5} data from 2010-2012. Currently, under the 2006 PM_{2.5} NAAQS, all Vermont monitors are in attainment for both the annual and daily PM_{2.5} standards.

Table 3 - PM_{2.5} 2012 Daily Design Value

Site	Design Value (µg/m ³) Years 2010-2012
Bennington	19*
Burlington	22*
Rutland	29*
Underhill	15*

**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_{2.5} Speciation Monitoring Network

The Vermont AQCD operates two PM_{2.5} 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 Dover, VT - Mt. Snow-Lye Brook are part of the IMPROVE (Interagency Monitoring of Protected Visual Environments) network. The Dover, VT, Mt Snow - monitoring site listed in this document is operated and maintained by the National Forest Service (NFS) and is not part of the Vermont AQCD network plan. The Burlington site is part of the EPA Speciation Trends Network (STN). The NFS previous IMPROVE site in Manchester, VT, on Mt Equinox, was retire Oct 1st of 2012.

The analysis of the filters generates data on chemical makeup of PM_{2.5}. 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_{2.5} 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

Pollutant	Sampler	Collection	Analytical Method	Analytes /Lab
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_{2.5} Monitoring Network

The Vermont AQCD operates four continuous PM_{2.5} sites (See Table 5). At this time, the VT AQCD operates three Thermo Scientific TEOM® 1400a Ambient Particular Monitor with Series 8500C FDMS® and one MetOne BAM 1020. All four network samplers have received their Federal Equivalency Method (FEM) certification by EPA. The R&P Model 8500C FDMS TEOM is operated at the Bennington, Burlington, and Underhill sites. The MetOne 1020 FEM is operated at the Rutland site and was install in July of 2012. All continuous PM_{2.5} samplers are operated year-round and have a collocated PM_{2.5} FRM or FEM sampler for comparative analysis. Data is reported to 1-hour averaging periods. The data is currently used for PM_{2.5} AQI determination and trends analysis.

40 CFR Part 58.11(e) provides that if the State agency operates continuous monitors with FEM certification in the network greater than 24 months, they must be report as regular PM_{2.5} parameter AQS method code designation PM_{2.5} LC 88101. VT AQCD must formally notify Region 1 EPA NE that the continuous PM_{2.5} monitors will not be reported as NAAQS determination monitors (AQS Code 88101 PM_{2.5} LC) until the annual and seasonal collocated datasets comply with the with the assessment show CFR Part 53 – Subpart C, Table C-4 designated control parameters.

The Bennington continuous PM_{2.5} FEM monitor has been operated for over 24 months, however the monitor does not fall consistently within the assessment specifications, demonstrating proper correlation to FRM filter based samples. This fact alone has and will continue to prevented the State of Vermont AQCD from reporting continuous PM_{2.5} results as PM_{2.5} LC (88101) for NAAQS determination at the Bennington location. Until this uncertainty and poor correlation is rectified, data from the Bennington continuous FEM PM_{2.5} sampler will not be reported for NAAQS compliance.

The Rutland and Underhill continuous PM_{2.5} monitor has been in operation greater than 24 months of operation. Both monitors fall marginally within the assessment specifications,

demonstrating proper correlation to FRM filter based samples. Therefore stating in 2014 the data will be reported as PM_{2.5} LC 88101.

The Burlington continuous PM_{2.5} FEM monitor does not have a collocated FRM sampler on-site, however AQCD utilizes the Burlington- Zampiere site FRM sampler (located approximately 500 meters NW of the Main St site) to make a correlation assessment. This sampler has consistently demonstrated in the past, good correlation utilizing internal assessments to the local FRM site. Data from this instrument will be reported as PM_{2.5} LC 88101 in 2014.

Vermont AQCD is required to provide EPA with an assessment (see Figures 2-4 below) of the FEM continuous data results compared to the collocated FRM data. The VT AQCD also evaluates continuous PM_{2.5} sampling methods utilizing internal assessment method quarterly at all four current SLAMS and N CORE sites. All maintenance and QA/QC procedures, audits and sample handling have been performed as required.

Figure 2 2010 - 2012 Bennington Comparative Assessment

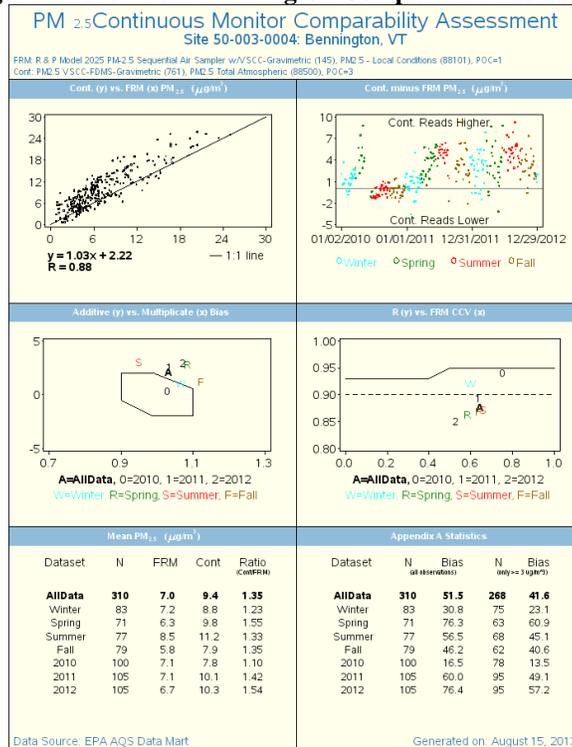


Figure 3 2012 Rutland Comparative Assessment

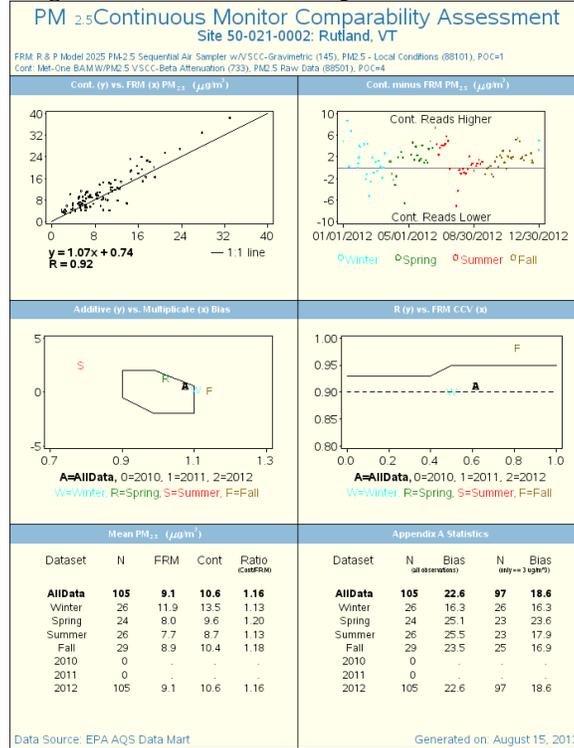


Figure 4 2010-2012 Underhill Comparative Assessment

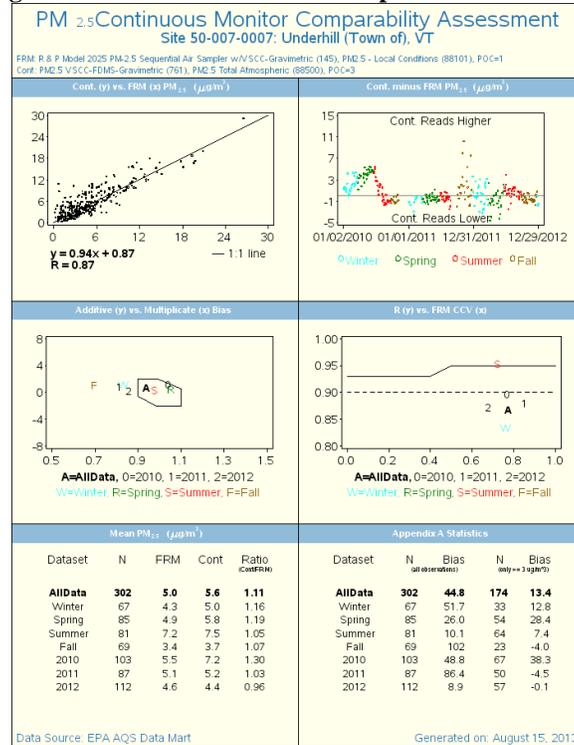


Table 5 - Continuous PM_{2.5} Method

Pollutant	Sampler	Collection	Analytical Method	Reported Data Interval / Location
PM _{2.5}	Thermo Scientific Model 8500 FDMS TEOM EQPM-0609-181	Low Volume Filter/ microbalance	Continuous gravimetric	1 Hour Bennington Burlington Underhill
PM _{2.5}	Thermo Scientific Model 1405F FDMS TEOM EQPM-0609-181	Low Volume Filter/ microbalance	Continuous gravimetric	1 Hour Not in Use
PM _{2.5}	MetOne BAM1020 EQPM-0308-170	Low Volume Filter/ microbalance	Continuous gravimetric	1 Hour Rutland

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

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

Ozone Monitoring Network

The Vermont AQCD 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

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

Ozone Design Value (2010-2012)

Below are the current design values for ozone from 2009-2012 (See Table 8). Ozone design values are calculated by taking the 3-year average of the annual 4th 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 2012 Design Values

Site	Design Value (PPM) Years 2010-2012
Bennington	.064
Underhill	.062

Ambient Air Toxics Monitoring Network

The Vermont AQCD 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⁺⁶ (Cr⁺⁶ will be terminated 6/27/13) 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 (sub atmospheric)	TO-15 (GC/MS)	54 VOC Compounds ERG and/or VT DEC
Carbonyl	ATEC 2200	DNPH Cartridge- 24 Hour	TO-11A (HPLC)	4 Carbonyl Compounds VTDEC
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 (Terminated 6/27/13)	VT AQCD 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

PM₁₀ Monitoring Network

The Vermont AQCD operates three PM₁₀ 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[®] filter (See Table 10 – PM₁₀ 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 PM₁₀ 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 Rutland and Burlington the AQCD has deployed the TEI 2025iD (dichotomous sampler) which provides PM_{2.5} and PM_{coarse}, as well as PM₁₀ concentration measurements. Data from these units will be uploaded to AQS starting first quarter 2013.

In Underhill, two collocated low-volume R&P 2025 samplers are configured to collect PM₁₀. The sample is collected on a 47mm Teflon[®] 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 – PM₁₀ Sample/Analysis Method

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

Nitrogen Dioxide Monitoring Network

The Vermont AQCD operates two nitrogen oxide (NO_x) 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_x samplers are operated year-round. Underhill NCore monitoring commenced fall of 2010 which includes NO_y 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 _y (TL)	Ecotech EC9841T Automated Reference Method: RFNA-1292-090	Continuous sampling	Chemiluminescence	1 Hour

Nitrogen Dioxide Design Value (2012)

Below are the current calculated 1-Hr & Annual design values for Nitrogen Dioxide from 2010-2012 (See Table 12 & 13). Nitrogen Dioxide design values are calculated by taking the 3-year average of the 98th percentile daily maximum 1-hour nitrogen dioxide averages. The current 1-hour nitrogen NAAQS standard is 100 parts per billion. The current annual NAAQS NO₂ 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 2012 1- Hr Design Values

Site	Design Value (PPB) Years 2010-2012
Burlington	38
Rutland	38

Table 13 – Nitrogen Dioxide 2012 Annual Average

Site	2012 Design Value (PPB)
Burlington	6.5
Rutland	7.4

Carbon Monoxide Monitoring Network

The Vermont AQCD 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: RFCA-0981-054	Continuous sampling	Infra-red	1 Hour
Carbon Monoxide (TL)	Ecotech EC9830 Automated Reference Method: RFCA-0992-088	Continuous sampling	Infra-red	1 Hour

Table 15 – Carbon Monoxide Design Value 2012

Site	2012 Design Value (CO PPM)
Burlington CO -1 Hour	1.3
Burlington CO -8 Hour	1.0
Rutland CO -1 Hour	2.6
Rutland CO -8 Hour	1.5
Underhill CO -1 Hour	0.55
Underhill CO -8 Hour	0.2

Sulfur Dioxide Monitoring Network

The Vermont AQCD operates two sulfur dioxide (SO₂) analyzers, located in Rutland and Underhill monitoring sites. The SO₂ samplers are operated year-round. SO₂ concentrations are determined by a continuous pulsed fluorescence method (See Table 16– Sulfur Dioxide Monitoring Method)

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 (SO₂). 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: EQSA-0486-060	Continuous sampling	Pulsed Fluorescence	1 Hour
Sulfur Dioxide (TL)	TEI 43C – TL Automated Equivalent Method: EQSA-0486-060	Continuous sampling	Pulsed Fluorescence	1 Hour

Table 17 – Sulfur Dioxide Design Values 2012

Site	Design Values (SO₂ PPB) Average of Years 2010-2012 1 Hour 99th Percentile Daily Max
Rutland – 1 Hour	21
Underhill – 1 Hour	4*

- **Design value for Underhill does not have full three years as required for proper calculation.**

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 _{2.5} FRM	PM _{2.5} TEOM	PM ₁₀ FRM	PM ₁₀ Low Volume/(metals)	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	✓	✓				✓		✓	✗	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	
Burlington	108 Cherry Street					✓		✓							✓	✓	✓	✓	✓	✓	✓	
Dover	Mount Snow					✓																
Rutland	Merchants Row	✓	✓		✓			✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Underhill	Harvey Road	✓	✓	✓	✓	✓		✓	✓	✗	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓

P=Proposed T=Trace Level

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 _{2.5} FEM	PM _{2.5} TEOM	PM ₁₀ FRM (collo)	PM _{10,2.5} 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 VTAQCD and EPA Region 1.

General Monitoring Description & Objectives:

The Burlington monitoring site objective for the CO & NO₂ measurements is compliance and trends purposes. Historically, CO and NO₂ measurements at this site are well below the NAAQS. Monitoring for CO and NO₂ at this site continues to be operated into the future primarily for trends analysis. The objective of the PM₁₀ monitoring is collect PM₁₀ 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_{2.5} 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 replaced Wedding PM10 collocated samplers with 2025i Dichotomous sampler.

Figure 5 - Burlington Aerial Photo

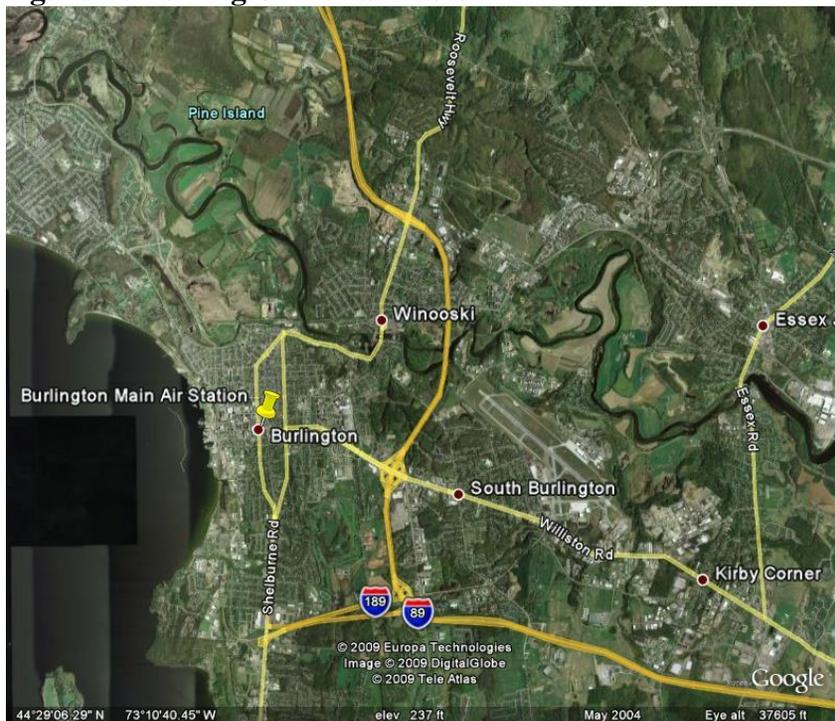


Figure 6 - Burlington Monitoring Shelter



Figure 7 - Burlington Aerial Photo

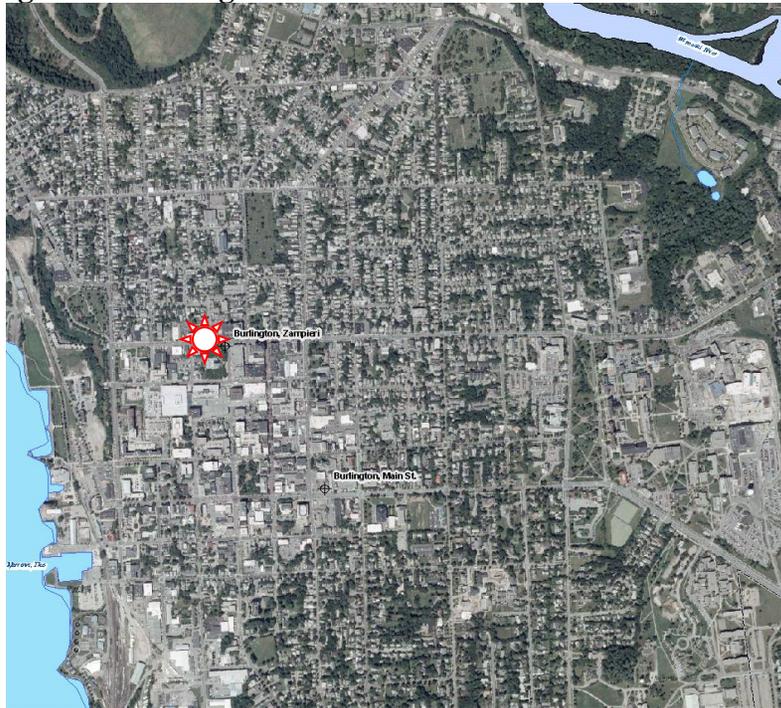
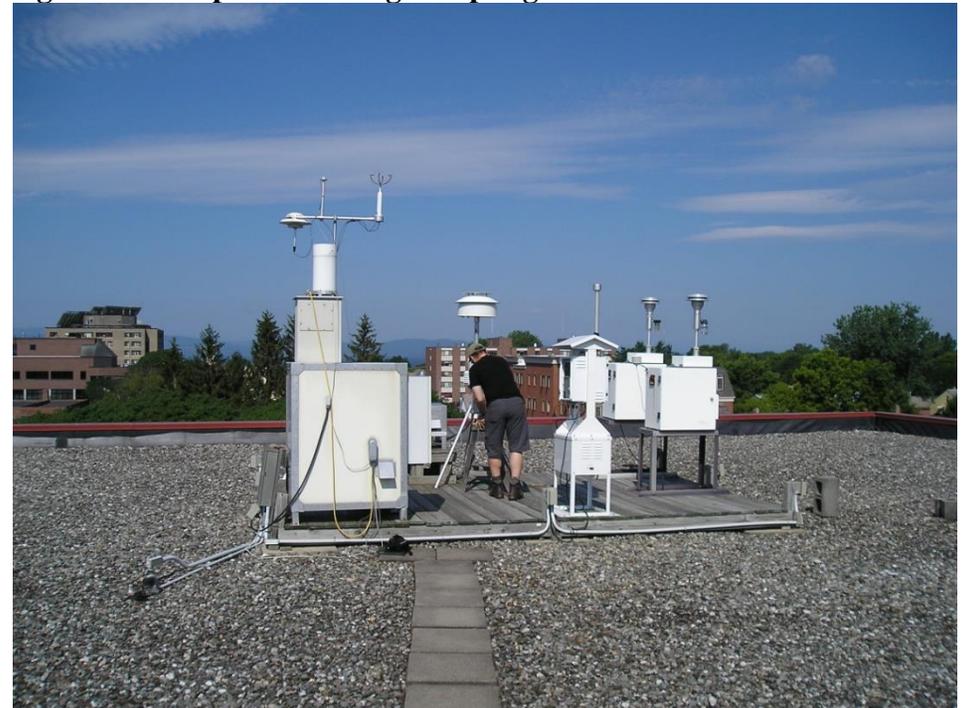


Figure 8 - Zampieri Building Sampling Platform



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: **2012**
Statistical Area: **Bennington, VT Micropolitan Area**

Location	Site	Carbon Monoxide	Nitrogen Dioxide	Ozone	Sulfur Dioxide	Speciation (STN)	Speciation (IMPROVE)	PM _{2.5} FRM	PM _{2.5} TEOM	PM ₁₀ FRM	PM ₁₀ Low Volume	VOC	Carbonyl	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Rain Fall	Pressure	
West Dove	Mount Snow						✓															

Site Description:
This monitoring location is not part of the Vermont AQCD 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 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 <http://vista.cira.colostate.edu/views/Web/SiteBrowser/SiteBrowser.aspx> . The site is identified in the data search as LYEB1. 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 2012

Figure 9 - Aerial View Mount Snow

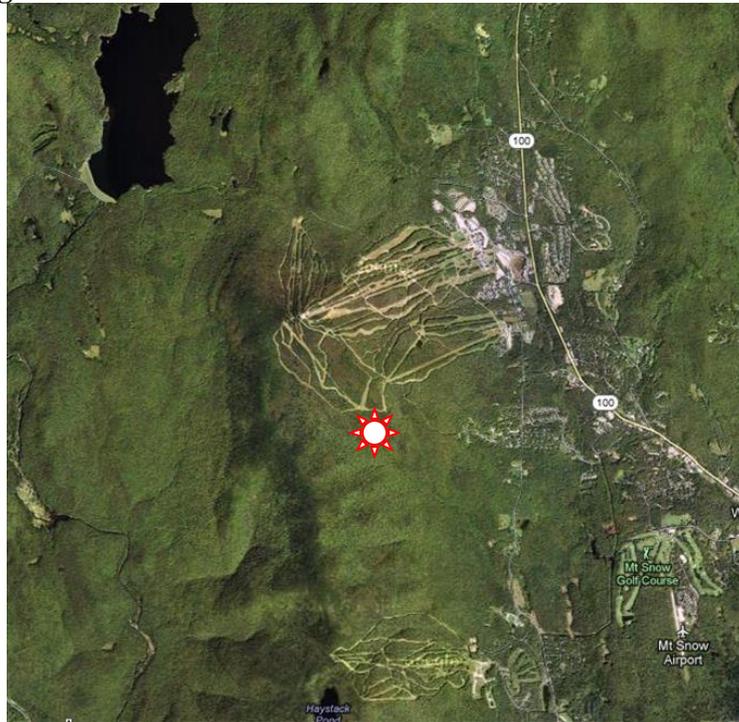


Figure 10 - View of Monitor Location



Site Description: **Manchester – Lye Brook Wilderness (Retired October 1st 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 _{2.5} FRM	PM _{2.5} TEOM	PM ₁₀ FRM	PM ₁₀ 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 AQCD 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 11- Aerial View Lye Brook Wilderness

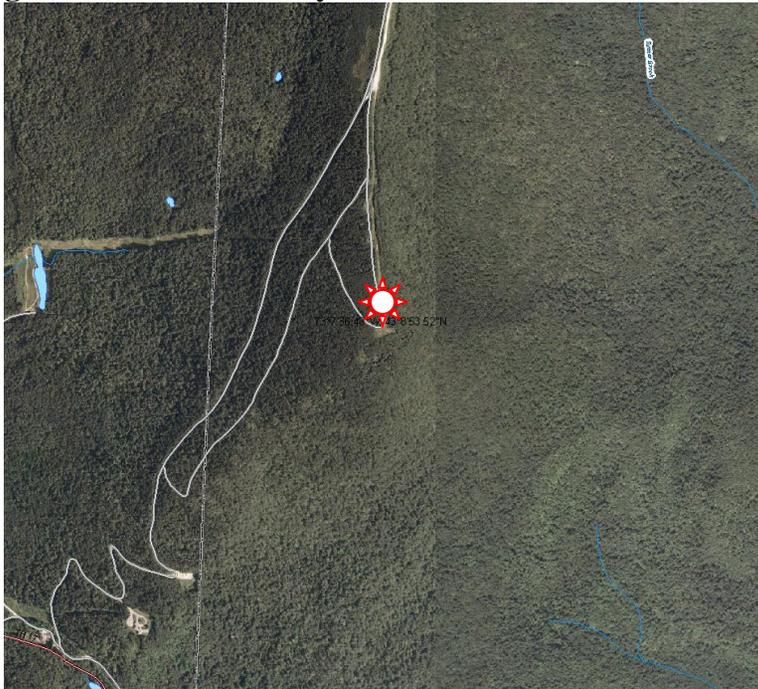


Figure 12 - View of Monitor Location



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 _{2.5} FRM	PM _{2.5} TEOM	PM ₁₀ FRM	PM ₁₀ 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 VTAQCD and EPA Region 1

General Monitoring Description & Objectives:
This monitoring objective for O₃ and PM_{2.5} FRM is compliance and trends analysis. The site represents a background / transport site with regional scale of exposure. The O₃ and continuous PM_{2.5} 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 13 - Aerial View Bennington

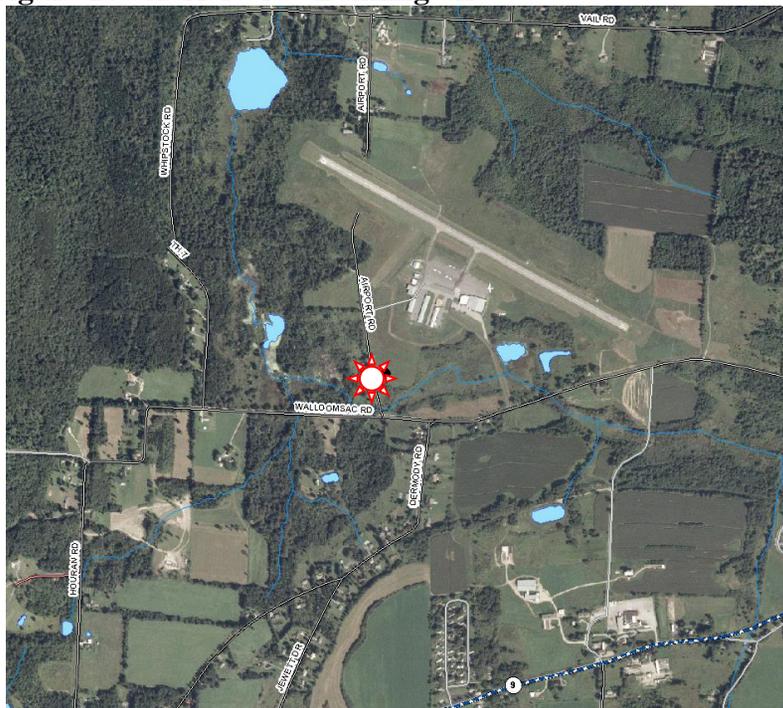


Figure 14 - Bennington Trailer



Figure 15 - Aerial View Underhill

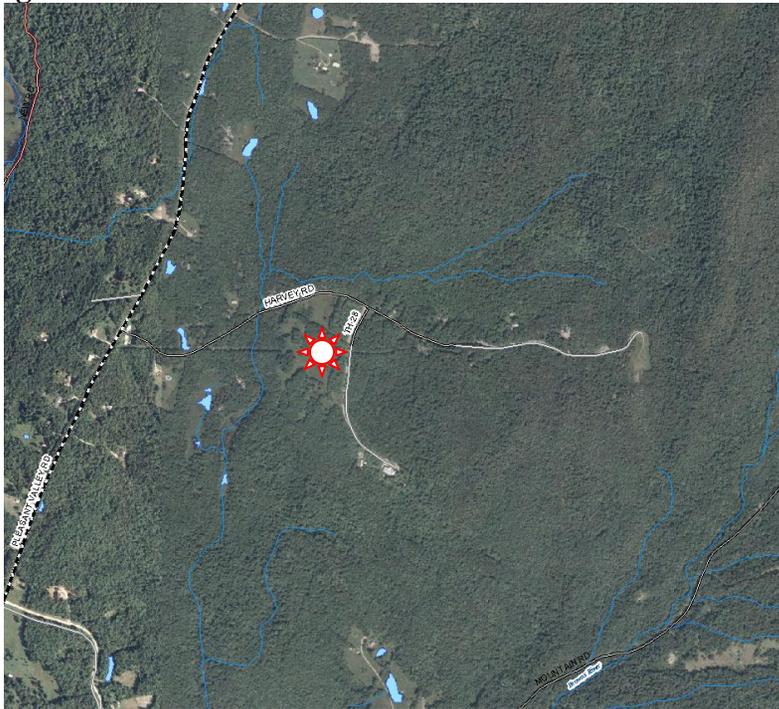


Figure 16 - Underhill Sampling Deck & Trailer



Site Description: Rutland – 96 State Street

Town – Site **Rutland – State St.**
County: **Rutland** Latitude: **+43.608056**
Address: **96 State St.** Longitude: **-72.982778**
AQS Site ID: **50-021-0002** Elevation: **165 m**
Spatial Scale: **Urban and Center City** Year Established: **1971**
Statistical Area: **Rutland, VT Micropolitan Area**
 Rutland, VT Micropolitan NECTA

Location	Site	Carbon Monoxide	Nitrogen Dioxide	Ozone	Sulfur Dioxide	Speciation (STN)	Speciation (IMPROVE)	PM _{2.5} FEM Continuous	Video Camera	PM _{2.5} FRM	PM _{10-2.5} Low Volume	VOC	Carbonyl	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Rain Fall	Pressure
Rutland	96 State Street	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Site Description:
This site is located in a court house parking lot in the downtown area of Rutland, 1 km from north junction of Route 7 & Route 4, 3.5 km from south junction of Route 7 & Route 4, 4 km NW of GE plant. The site is adjacent to a postal center distribution center which serves as the parking area for mail service vehicles. This monitoring location meets all siting requirements and criteria and has been approved by VTAQCD and EPA Region 1

General Monitoring Description & Objectives:
The monitoring objective for CO, NOX, PM_{2.5}, PM₁₀ and SO₂ is for compliance purposes and 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. WS/WD & Temp/RH data is collected from a 10.0 meter tower.

Plans/History:

- Site Established 1971
- Fall 2012 replaced Wedding PM₁₀ with TEI 2025i Dichotomous (PM_{10-2.5} & PM_{2.5}) unit.

Figure 17 - Aerial View Rutland

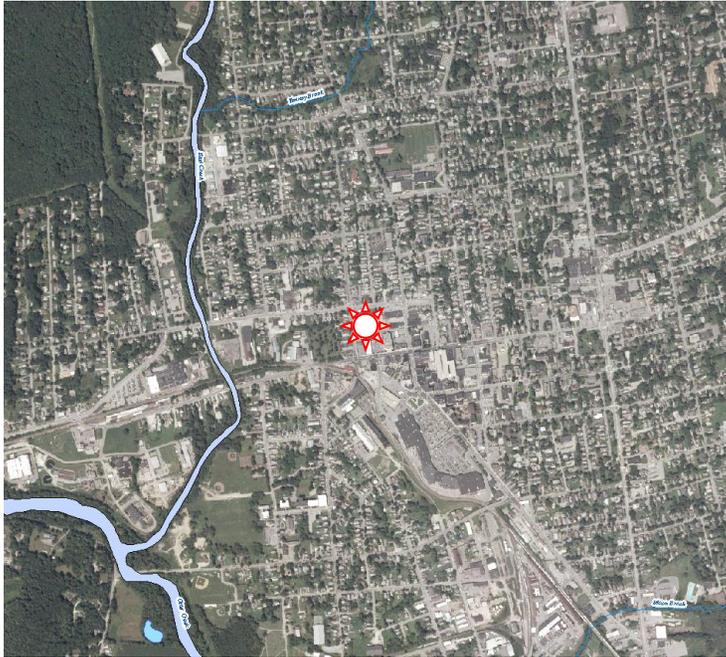


Figure 18 - Rutland Trailer



Appendix A – List of Analytes for Analytical Methods

Table 19 – Elemental Metals Analytes for PM₁₀ (47 mm Teflon;ERG:2013)

Metal	MDL (ng/m³)*	Metal	MDL (ng/m³)*
Antimony	0.047	Lead	0.10
Arsenic	0.20	Manganese	0..14
Beryllium	0.016	Mercury	0.025
Cadmium	0.014	Nickel	0.25
Chromium	17	Selenium	0.30
Cobalt	0.023	Chromium^{+6**}	0.0038

*ERG analysis; assumes 24.04 m³ except for ** Cr⁺⁶ suspended on 6/27/13

Table 20 – List of Analytes for Speciation Sampling

Analysis	Analytes	MDL
Gravimetric	Mass	300 ng/m³
HIPS	Optical Absorption	0.2 Mm⁻¹
XRF	Elements Fe to Pb	0.05 - 0.18 ng/m³
PIXE	Elements S to Mn	1 - 4 ng/m³
	Element Na	20 ng/m³
PESA	Elemental H	4 ng/m³
IC	NO₃, SO₄, NH₄	10 - 30 ng/m³
	NO₂, Cl	60 - 100 ng/m³
TOR	Organic Carbon	250 ng/m³
	Elemental Carbon	100 ng/m³

Table 21- List of Carbonyl Analytes (2013)

Carbonyl Compound	VT DEC MDL (µg/m³)*	ERG MDL (µg/m³)**
Formaldehyde	0.017	0.014
Acetaldehyde	0.002	0.013
Acetone	0.008	0.036
Propionaldehyde	0.006	0.008

*: assumes 1.294m³ total sample volume **: assumes 1000 L total sample volume

Table 22 - Analyte List for VOC Analysis (ERG:2013)

VOC Compound	MDL ($\mu\text{g}/\text{m}^3$)
1,1,1-Trichloroethane	0.091
1,1,2,2-Tetrachloroethane	0.246
1,1,2-Trichloroethane	0.057
1,1-Dichloroethane	0.054
1,1-Dichloroethene	0.043
1,2,4-Trichlorobenzene	0.082
1,2,4-Trimethylbenzene	0.054
1,2-Dibromoethane	0.085
1,2-Dichloroethane	0.046
1,2-Dichloropropane	0.142
1,3,5-Trimethylbenzene	0.232
1,3-Butadiene	0.027
Acrolein	0.032
Acrylonitrile	0.024
Benzene	0.04
Bromochloromethane	0.061
Bromodichloromethane	0.099
Bromoform	0.123
Bromomethane	0.048
Carbon Tetrachloride	0.100
Chlorobenzene	0.071
Chloroethane	0.036
Chloroform	0.076
Chloromethane	0.031
Chloroprene	0.069
cis-1,2-Dichloroethylene	0.064
cis-1,3-Dichloropropene	0.060
Dibromochloromethane	0.143

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	0.075
Dichlorotetrafluoroethane	0.132
Ethyl Acrylate	0.064
Ethyl tert-Butyl Ether	0.056
Ethylbenzene	0.062
Hexachloro-1,3-butadiene	0.187
m,p-Xylene	0.071
m-Dichlorobenzene	0.113
Methyl Isobutyl Ketone	0.063
Methyl Methacrylate	0.072
Methyl tert-Butyl Ether	0.060
Methylene Chloride	0.042
n-Octane	0.065
o-Dichlorobenzene	0.107
o-Xylene	0.075
p- Dichlorobenzene	0.172
Styrene	0.076
tert-Amyl Methyl Ether	0.108
Tetrachloroethylene	0.108
Toluene	0.072
trans-1,2-Dichloroethy...	0.072
trans-1,3-Dichloropropene	0.106
Trichloroethylene	0.125
Trichlorofluoromethane	0.132
Trichlorotrifluoroethane	0.184
Vinyl Chloride	0.073

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

Table 23 - Analyte List for PAH Analysis (ERG: 2013)

PAH Compounds	ng/m³
Naphthalene	0.207
Acenaphthylene	0.039
Acenaphthene	0.038
Fluorene	0.052
9-Fluorenone	0.054
Fluoranthene	0.044
Pyrene	0.047
Phenanthrene	0.040
Anthracene	0.027
Retene	0.095
Benz(a)anthracene	0.076
Cyclopenta(c,d)pyrene	0.038
Chrysene	0.023
Benzo(b)fluoranthene	0.040
Benzo(k)fluoranthene	0.050
Benzo(e)pyrene	0.051
Benzo(a)pyrene	0.051
Perylene	0.036
Indeno(1,2,3-cd)pyrene	0.033
Dibenz(a,h)anthracene	0.037
Benzo(g,h,i)perylene	0.036
Coronene	0.049

Appendix B – National Ambient Air Quality Standards As of October 2012

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3 month average	0.15 µg/m ³ ⁽¹⁾	Not to be exceeded
Nitrogen Dioxide [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 ⁽²⁾	Annual Mean
Ozone [73 FR 16436, Mar 27, 2008]		primary and secondary	8-hour	0.075 ppm ⁽³⁾	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution Dec 14, 2012	PM _{2.5}	primary	Annual	12 µg/m ³	annual mean, averaged over 3 years
		secondary	Annual	15 µg/m ³	annual mean, averaged over 3 years
		primary and secondary	24-hour	35 µg/m ³	98th percentile, averaged over 3 years
	PM ₁₀	primary and secondary	24-hour	150 µg/m ³	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		primary	1-hour	75 ppb ⁽⁴⁾	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 1970 lead standard (1.5 µg/m³ 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 1970, 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 NO₂ 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 SO₂ 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.

*For current changes that may not be reflect tin the above NAAQS table please visit <http://epa.gov/air/criteria.html>

References

1. United States Environmental Protection Agency Air and Radiation - National Ambient Air Quality Standards (NAAQS) March 2, 2007 <http://epa.gov/air/criteria.html>
2. 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>
3. 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>
4. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 50, Protection of Environment, June 24, 2012.](#)
5. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 53, Protection of Environment, June 24, 2012.](#)
6. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 58, Protection of Environment, June 24, 2012.](#)