

Draft Vermont Annual Air Monitoring Network Plan 2016



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
CBSA – Core Based Statistical Area
CFR – Code of Federal Regulations
CO – Carbon Monoxide
CSA – Combined Statistical Area
EPA – Environmental Protection Agency
FDMS – Filter Dynamic Measurement System
FEM – Federal Equivalent Method
FRM – Federal Reference Method
GIS – Geographical Information Systems
HAAS – Hazardous Ambient Air Standard
HAP – Hazardous Air Pollutants
IC – Ion Chromatography
IO – Inorganic
LC – Local Conditions of Temperature and Pressure
MQO – Measurement Quality Objectives
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
NO₂ – Nitrogen Dioxide
NO_x – Oxides of Nitrogen
NO_y – Reactive Oxides of Nitrogen
O₃ – Ozone
OAQPS – Office of Air Quality Planning and Standards
PAH – Polycyclic Aromatic Hydrocarbon
PIXE – Proton Induced X-ray Emission
PM₁₀ – Particulate ≤10 micron aerodynamic particle size
PM_{2.5} – Particulate ≤2.5 micron aerodynamic particle size
PM_c – Coarse Particulate between 10 and 2.5 micron aerodynamic particle size (PM_{10-2.5})
PMSA – Primary Metropolitan Statistical Area
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
STP – Standard Temperature and Pressure
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, 2016 an air monitoring network plan for the State of Vermont. The regulation requires that the network plan be posted on the AQCD website or other form of notification for public comment 30 days prior to submission to the EPA Region 1 Office.

The current air monitoring network plan is available for public review on the AQCD website, <http://dec.vermont.gov/air-quality/monitoring>, for the 30-day comment period prior to submittal to EPA.

Please send all comments regarding Vermont Air Monitoring Network Plan:

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Vermont Air Monitoring Network Plan Overview

The Vermont Air Quality & Climate Division (AQCD) is a division within the Vermont Department of Environmental Conservation (DEC), which is one of three departments in the Vermont Agency of Natural Resources. The mission of the AQCD is to implement the Clean Air Act and Vermont State Statutes related to air quality. The AQCD regulates air quality to protect public health and the environment. As part of that effort, air monitoring data is required to be collected by federal regulations as put forth in the federal Clean Air Act, 40 CFR Parts [50](#), [53](#), [58](#), and the [Vermont Statute Title 10, Part 1, Chapter 23, § 575](#). The collected data is utilized 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 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 environmental trends in air quality.

This document provides general information and overview of the Vermont Air Quality & Climate Division's air monitoring operational network. It also provides a brief annual summary of the Vermont "[NAAQS Design Values](#)" where applicable, and some of the major activities and changes scheduled for the upcoming year.

VT AQCD Air Monitoring Program Overview

Air pollution is created by many anthropogenic sources such as cars, trucks, buses, factories, and power plants, as well as natural sources such as forest fires, volcanoes, and wind storms. The air pollution emanating from these sources can be local or transported from great distances. The amount of particulate, carbon monoxide (CO), Sulfur Dioxide (SO₂), and nitrogen dioxide (NO₂) emitted into the ambient air has been greatly reduced by control strategies and equipment applied to industrial sources. 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 NO₂, CO and volatile organic compounds (VOCs). 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 on various emission sources are expected to provide further reductions of air pollutants in the future.

Ambient air monitoring is valuable service, which is essential for state and federal environmental planning, enforcement efforts, air pollutant 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 better quality particulate sampling and continuous monitoring of gaseous criteria pollutants such as CO, SO₂, 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.

The Vermont AQCD currently operates and maintains five permanent air monitoring stations and is proposing to consolidate the two Burlington sites and reduce to four permanent stations beginning 2017. 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 six criteria pollutants and 96 toxic pollutants. The operation of all the SLAMS, NCore and CSN air monitors in the network meets the requirements in *40 CFR Part 58, Appendices A, C, D and E*. The criteria pollutant monitoring methods utilized by the VT AQCD are EPA federal reference method (FRM) or federal equivalent method (FEM) designated instruments.

All EPA CAA §105 & §103 grants agreements with VT AQCD require a Quality Assurance Project Plan (QAPP), an annual Work Plan, and Standard Operating Procedures (SOPs). These are reviewed annually and a summary update report is submitted to EPA annually by November 1st. The AQCD QAPPs and SOP for Criteria Pollutants, PM_{2.5} and Air Toxics & National Air Toxics Trend Sites (NATTS) have received initial EPA approval. The annual updates for the Air Toxics & NATTS QAPP was submitted in December, 2015. The annual update for the PM 2.5 QAPP and SOPs is pending. The Criteria Pollutant QAPP required a complete revision and is considered overdue by EPA. The updated QAPP is scheduled for submission to EPA Region 1 on June 1, 2016 for review and EPA approval. The Meteorological QAPP is pending and will be finalized, submitted, to EPA in 2016.

The Federal EPA National Ambient Air Quality Standards

The [Clean Air Act](#) of 1990 requires EPA to set [National Ambient Air Quality Standards](#) (40 CFR part 50) for pollutants that are deemed harmful to public health and the environment. The Clean Air Act presents two types of national ambient air quality standards: Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly; Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

EPA identified National Ambient Air Quality Standards for six principal pollutants, which are called "criteria" pollutants. They are listed in Appendix B of this document. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, or micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$).

On December 16, 2006, the EPA reduced the daily $\text{PM}_{2.5}$ NAAQS from $65 \mu\text{g}/\text{m}^3$ to $35 \mu\text{g}/\text{m}^3$. The annual $\text{PM}_{2.5}$ NAAQS remained $15 \mu\text{g}/\text{m}^3$. Vermont operates a small network of FRM filter based samplers as well as FEM for continuous $\text{PM}_{2.5}$ to assess air quality for $\text{PM}_{2.5}$.

On Dec 12, 2012, the EPA set the $\text{PM}_{2.5}$ primary annual $\text{PM}_{2.5}$ standard to $12 \mu\text{g}/\text{m}^3$ and the secondary standard was set to $15 \mu\text{g}/\text{m}^3$. This annual $\text{PM}_{2.5}$ average will be computed as the average of the last three years. As an example: The average for 2012 would be the annual averages from 2010, 2011 and 2012. On January 15, 2013, EPA established that all continuous $\text{PM}_{2.5}$ FEM monitors operating for more than 24 months be used for comparison to the NAAQS unless the State specifically requests that the data be excluded as is provided under 40 CFR Part 58.11(e).

On December 16, 2006, a regulation update addressed the creation of a multi-pollutant National Core (NCore) site network 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 20 rural sites within the NCore network. The upgrades to the existing site required the addition of "trace level" monitoring for Carbon Monoxide, Nitrogen Oxides, and Sulfur Dioxide.

On November 12, 2008, the NAAQS for lead was strengthened to 0.15 micrograms per cubic meter for both the primary and secondary standard. 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 that the State of Vermont does not meet the regulation requirements with regard to population thresholds for the Core Based Statistical Area (CBSA). Vermont airports do not meet "take off" & "landing" thresholds, and 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 the ambient air lead 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 PM_{10} sampling with subsequent multi-metals analysis (Pb included). On December 19, 2014, the EPA reviewed the standard requirements and opted to retain the existing standards.

The ozone primary and secondary NAAQS for 8-hour average of 0.070 parts per million was adopted on December 28, 2015. At this time, Vermont is in compliance with the current NAAQS ozone 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.

The final rule for NO₂ NAAQS for was adopted on January 22, 2010. The new 1-hour average NO₂ NAAQS is based on the 3-year average of the 98th percentile of the 1-hour daily maximum. The 1-hour NAAQS value was set at 100 parts per billion. EPA, in cooperation with States/Local/Tribal agencies, will set up 40 NO₂ monitors nationwide to help protect communities that are susceptible to NO₂ health effects. Vermont is not currently 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.

A new 1-Hour SO₂ NAAQS was adopted on June 2, 2010. EPA strengthened the primary NAAQS for SO₂ by establishing a 1-hour standard level of 0.075 ppm. The new design value 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 annual standard (30 ppb). The 2010 Vermont state recommended design value uses 2008, 2009, and 2010 SO₂ summary data. Vermont is not currently required under the new rule to set up additional SO₂ monitors in the network, beyond what is currently in Rutland. EPA finalized its Data Requirements Rule for the 1-hour Sulfur Dioxide Primary National Ambient Air Quality Standard (NAAQS) on August 21, 2015 (80 FR 51052), and provided detailed monitoring and modeling guidance for implementing the SO₂ standard.

Changes July 2015 to June 2016 Air Monitoring Network

The Vermont AQCD network changes, additions, and deletions that were planned for the 12-month period of July 2015-June 2016 were:

1. Replaced 2025 with 2025i units at Burlington Cherry Street and Underhill NCore Sites.
2. Suspended PM_{2.5} weighing services due to multiple unresolvable problems with AQCD weighing room in Berlin VT. – September 2015.
3. Due to #2 above, suspended filter-based PM sample collection – September 2015.
4. FEM continuous PM_{2.5} monitors (TEOM and BAM) identified as Primary for EPA AQS submittal used for NAAQS determinations – September, 2015.
5. Arranged through EPA Region 1 to have CT DEEP perform PM weighing services – January 2016.
6. Suspended plans for locating AQCD weighing room in the proposed new AG/DEC laboratory building to be located in Randolph – March 2016.
7. Suspended operation of PM_{2.5} FRM 2025 sampler at Bennington Site as considered unnecessary given that the TEOM monitor is designated as Primary for this site and collocation for this method is performed at Underhill site – April 2016.
8. Replaced 2025iD Dichotomous sampler at Rutland with PM₁₀ FRM 2025; Determined Dichotomous sampler was unnecessary and overly resources intensive. PMCoarse will still be determined by subtraction (PM₁₀ FRM- PM_{2.5} FRM) as performed at Underhill NCore site – April 2016.
9. Established Ozone monitoring at the Rutland Site – April 2016.
10. Prepared AQI reporting for new Ozone NAAQS.

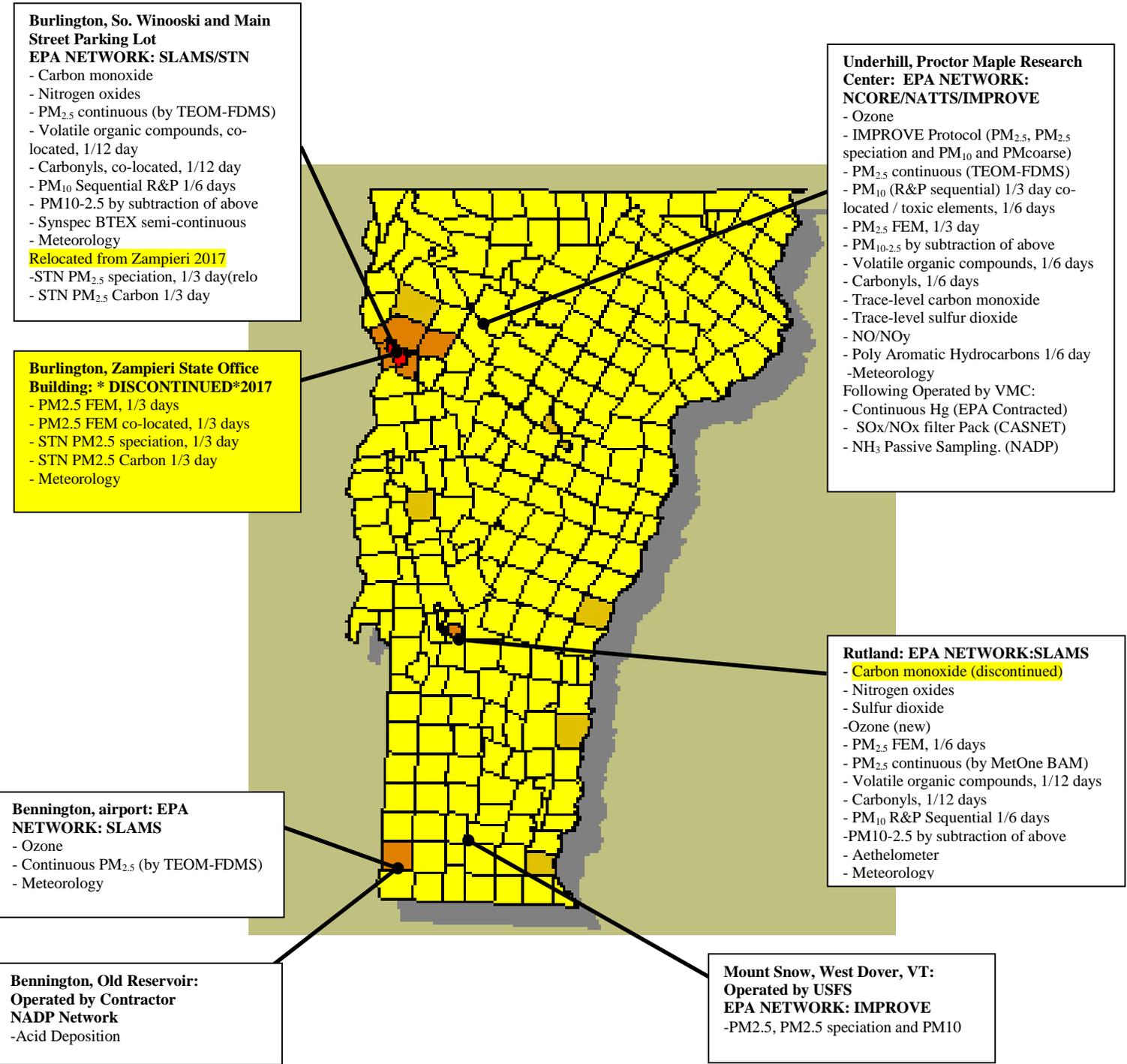
Proposed Changes July 2016 to June 2017 Air Monitoring Network

The Vermont AQCD network changes, additions and deletions that are planned for the next 12 months of July 2016-June 2017 are:

1. Discontinue operation of Burlington Cherry Street Site (Zampieri Bldg, roof) due to redundancy with Burlington Trailer site, siting issues and focus on continuous PM FEM methods.
2. Relocate STN (SASS/URG) samplers from Burlington Cherry Street site to Burlington Main St. Site – January 2017.
3. Discontinue 2025iD Dichotomous sampler at Burlington Main St. Site based on EPA Region 1 recommendation that it is not required – January 2017.
4. Install a PM₁₀ FRM 2025i at the Burlington Main St. Site– January 2017
5. Discontinue CO monitoring at Rutland site based on EPA Region 1 recommendation and *40 CFR Part 58.14 (c)(1)* related to continued low level results well below the NAAQS – January 2017.
6. Reduce PM_{2.5} and PM₁₀ FRM 2025i sample collection frequency at Rutland, Burlington and Underhill (PM₁₀ collocated only) to 1-in-6 day – August 1, 2016.
7. Procure new CO & SO₂ trace level instrumentation for Underhill NCore site – Summer 2016.
8. Procure new station dilution/O₃ calibrators for Rutland and Bennington Sites – Summer 2016.
9. Begin developing plan for alternative field operations space in Central Vermont area
10. Begin developing plan for new monitoring site location in Burlington due to a notification from the City of Burlington that the current shelter will need to be relocated within 18-24 months due to redevelopment of parking lot – ongoing.
11. Consider development of new public outreach AQCD real-time website to accommodate new AgileWeb data format of Air Vision – ongoing.
12. Continue long term arrangement with Connecticut DEEP for PM filter weighing services – ongoing.

Figure 1 – Vermont Air Monitoring Network Plan Map

2016 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 currently 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 Vermont AQCD will discontinue the Burlington Cherry Street site beginning 1/1/17 and will relocate any non-redundant samplers to the Burlington Main Street site. Consequently, there will be only 3 permanent PM_{2.5} FRM sites operated in the network beginning in 2017 and the filter sample collection frequency will be reduced on 8/1/16 to 1-in-6 days for Rutland and Burlington PM_{2.5} samplers. Underhill NCore-based PM_{2.5} FRM sampling will remain on a 1-in-3 day sampling schedule.

The EPA approved sampling method collects 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 (performed by CT DEEP) 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} CT DEEP

“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 (2015)

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 12µg/m³.

Table 2 – PM_{2.5} Annual Design Value

Site	Design Value (µg/m ³) Years 2013-2015
Bennington	6.2
Burlington (Main St)*	6.3
Rutland	8.7
Underhill	4.0

*: Cherry Street Site is FRM only and does not meet completeness criteria for 2015

PM_{2.5} Daily Design Value (2015)

Below are the current daily design values from PM_{2.5} for 2015. 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 2013-2015. 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} 2015 24-Hour Design Value

Site	Design Value (µg/m³) Years 2013-2015
Bennington	15
Burlington (Main Street)*	15
Rutland	27
Underhill	12

*: Cherry Street Site is FRM only and does not meet completeness criteria for 2015

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-Cherry Street (Zampieri) and Underhill. The samplers operate on a 1-in-3 day schedule and produce a 24-hour integrated filter based sample. A third Vermont site not officially part of the AQCD network, which is operated and maintained by the National Forest Service (NFS), is located at Dover, VT. Both Underhill and Dover, VT - Mt. Snow-Lye Brook are part of the IMPROVE (Interagency Monitoring of Protected Visual Environments) network. The Burlington site is part of the EPA Speciation Trends Network (STN). The STN samplers listed in Table 4 will be relocated on the roof of the Burlington Main Street shelter effective 1/1/17 in connection with discontinuance of the Burlington Cherry St. site.

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-in-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/AMEC FosterWheeler
PM Carbon (STN)	URG 3000-N	Low Volume Multi Filter 24 Hour	Carbon Analysis	See Appendix A/ AMEC FosterWheeler
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). This currently includes two Thermo Scientific TEOM® 1400a Ambient Particular Monitor with Series 8500C FDMS®, one Thermo Scientific TEOM® 1405-F Ambient Particular Monitor, and one MetOne BAM 1020. All four network samplers have Federal Equivalency Method (FEM) designation from EPA. The Thermo Scientific Model 8500C FDMS TEOM is operated at the Burlington, and Underhill sites. The Thermo Scientific 1405-F is operated in Bennington and was installed in December 2014. The MetOne BAM 1020 FEM is operated at the Rutland site and was installed in July of 2012. All continuous PM_{2.5} samplers are operated year-round and each method (TEOM or BAM) has a collocated PM_{2.5} FRM sampler at one site in the network for collocated assessment and comparative analysis. Data is reported as 1-hour averages. The FEMs at all four sites are designated in AQS as the primary monitor as of September, 2015. The primary monitor and collocated monitor(s) are all deemed suitable for the applicable NAAQS comparison. 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. As of 2014, all continuous PM_{2.5} monitoring data from VT sites are reported as PM_{2.5} LC 88101.

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	Tapered Element Oscillating Microbalance	Continuous gravimetric	1 Hour Burlington Underhill
PM _{2.5}	Thermo Scientific Model 1405F FDMS TEOM EQPM-0609-181	Tapered Element Oscillating Microbalance	Continuous gravimetric	1 Hour Bennington (as of 12/1/14)
PM _{2.5}	MetOne BAM1020 EQPM-0308-170	Standard glass fiber filter tape	Continuous Beta Ray Attenuation	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 since 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

As of 4/1/2016, the Vermont AQCD operates three ozone sites in the air monitoring network, Bennington, Underhill and Rutland (new in 4/1/16). Currently, all ozone analyzers are operated year-round. Data is collected continuously and recorded as hourly averages. Ozone measurements are utilized to determine compliance with the 8-hour NAAQS, atmospheric transport modeling, and ozone precursor studies. 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: EQQA-0992-087	Continuoussampling	Ultraviolet Photometry	1 Hour

Ozone Design Value (2013-2015)

Below are the current design values for ozone from 2013-2015 (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 applicable NAAQS 8-hour ozone standard is 0.070 ppm (effective 12/28/15). Currently, all Vermont monitors are in attainment for ozone.

Table 8 – Ozone 8-Hour 2015 Design Values

Site	Design Value (PPM) Years 2013-2015
Bennington	0.062
Underhill	0.062
Rutland	N/A-new April-2016

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 NATTS network. The Burlington and Rutland air toxics monitoring sites are part of the VT AQCD air toxics network.

The air toxic sample collection and analysis program includes volatile organic compounds (VOC) and carbonyl compounds at all sites. The NATTS - Underhill site includes sampling and analysis for PM₁₀ metals 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 benzene, toluene, ethylbenzene and xylenes (BTEX). 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 Silco-coated SS Canister- 24 Hour (sub atmospheric)	TO-15 (GC/MS)	55 VOC Compounds VT DEC/AG Lab
Carbonyl	ATEC 2200	DNPH Cartridge- 24 Hour	TO-11A (HPLC)	4 Carbonyl Compounds VTDEC/AG Lab
Metals (Lead Included)	R&P 2025 PM ₁₀ Low- Volume	Teflon Filter- 24 Hour	IO-3.5 (ICP/MS)	15 Elements VT DEC/AG Lab
PAH	Tisch PUF +	PUF/XAD- 24 Hour	TO-13A (GC/MS)	22 PAH Compounds ERG
BTEX	Synspec GC955 Series 600	Semi- Continuous 15 Minute	GC-PID	5 VOC Compounds/direct measurement

PM10 Monitoring Network

The Vermont AQCD operates three PM₁₀ monitoring sites. The monitoring locations are Burlington, Rutland and Underhill. The network currently operates on a 1-in-3 day sampling schedule. Beginning on 8/1/2016 the PM₁₀ sampling schedule for the Rutland and Underhill Collocated sampler will be 1-in-6 days.

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 by CT DEEP.

The TEI 2025iD (dichotomous sampler) which provides PM_{2.5}, PM_{coarse} as well as PM₁₀ concentration measurements was discontinued at the Rutland site on April 11, 2016. The TEI 2025iD at the Burlington Main Street site is proposed to be discontinued at the beginning of 2017. A 2025 FRM configured for PM₁₀ was installed on 4/11/16 at the Rutland site after the 2025iD was removed. A 2025i FRM configured for PM10 will be installed at the Burlington Main Street site beginning 2017.

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 by Conneticut DEEP and is used to determine the mass concentration. These filters are subsequently submitted for metals analysis to the VT DEC/AG laboratory. The metals analysis performed does include the element lead (Pb). This ICP/MS analytical method is not designated by EPA as a FEM for Lead NAAQS determination, so Underhill Pb results for NATTS will be submitted to AQS with the 85128 code. The sampling schedule for the primary PM₁₀ is 1-in-3 days to meet NCore requirements and the collocated PM₁₀ will be operated on a 1-in-6 day schedule beginning on 8/1/16.

Table 10 – PM10 Sample/Analysis Method

Pollutant	Sampler	Collection	Analytical Method	Analytes /Lab
PM ₁₀	TEI 2025iD Manual Equivalent Method: EOPS-0311-198 *DISCONTINUED*	Low Volume 47 mm Teflon [®] Filter	Gravimetric	PM ₁₀ CT DEEP (beginning 1/1/16)
PM ₁₀	R&P 2025 Manual Reference Method: RFPS-1298-127	Low Volume 47 mm Teflon [®] Filter	Gravimetric	PM ₁₀ CT DEEP (beginning 1/1/16)

Oxides of Nitrogen (NO/NO₂/NO_x) and Total Reactive Oxides of Nitrogen (NO_y) Monitoring Network

The Vermont AQCD operates two nitrogen oxide (NO/NO₂/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 the continuous chemiluminescence method (See Table 11 – Nitrogen Dioxide Monitoring Method). The NO_x samplers are operated year-round. Beginning in 2010, total reactive nitrogen (NO_y) trace level monitoring is performed at the Underhill NCore monitoring site.

Table 11 – Nitrogen Dioxide and Total Reactive Nitrogen Monitoring Method

Pollutant	Sampler	Collection	Analytical Method	Reported Data Interval
Nitrogen Dioxide/Nitric Oxide	Teledyne-API T200 Automated Reference Method: RFNA-1194-099	Continuous sampling	Chemiluminescence	1 Hour
NO _y (TL)	Ecotech EC9843 Automated Reference Method: RFNA-1292-090	Continuous sampling	Chemiluminescence	1 Hour

Nitrogen Dioxide Design Value (2015)

Below are the current calculated 1-hour & Annual design values for Nitrogen Dioxide from 2013-2015 (See Table 12 & Table 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 dioxide.

Table 12 – Nitrogen Dioxide 2015 1-Hour Design Values

Site	Design Value (PPB) Years 2013-2015
Burlington	34
Rutland	37

Table 13 – Nitrogen Dioxide 2015 Annual Average

Site	2015 Annual Average(PPB)
Burlington	6.5
Rutland	7.4

Carbon Monoxide Monitoring Network

Currently, the Vermont AQCD operates two carbon monoxide (CO) analyzers located at the Burlington and Rutland monitoring sites. The CO analyzers are operated year-round. CO concentrations are determined by a continuous infra-red method (See Table 14 – Carbon Monoxide Monitoring Method). Beginning in 2010, trace level CO monitoring was performed at the Underhill NCore monitoring site using the instrument method identified in Table 14. Based on EPA Region 1 recommendation, the operation of the Rutland CO analyzer will be discontinued beginning in 2017 due to continued low level results significantly below the NAAQS.

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	Teledyne-API Model T300 Automated Reference Method: RFCA-1093-093	Continuous Sampling	Infra-red(Gas filter correlation)	1 Hour
Carbon Monoxide (TL)	Ecotech EC9830 Automated Reference Method: RFCA-0992-088	Continuous Sampling	Infra-red(Gas filter correlation)	1 Hour

Table 15 – Carbon Monoxide Design Value 2015 (Preliminary-based on 2nd max 1-hour and 8-hour values)

Site	2015 Design Value-(2 nd maximum PPM)
Burlington CO -1 Hour	0.8
Burlington CO -8 Hour	0.5
Rutland CO -1 Hour	3.5
Rutland CO -8 Hour	1.4
Underhill CO -1 Hour	0.35
Underhill CO -8 Hour	0.3

Sulfur Dioxide Monitoring Network

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

The level of the national primary 1-hour annual ambient air quality standard for oxides of sulfur is 0.075 parts per million, measured in the ambient air as sulfur dioxide (SO₂). The secondary standard is 0.500 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 (TL)	TEI 43C – TL Automated Equivalent Method: EQSA-0486-060	Continuous sampling	Pulsed Fluorescence	1 Hour
Sulfur Dioxide	Teledyne-API T100 Automated Equivalent Method: EQSA-0193-092	Continuous sampling	Pulsed Fluorescence	1 Hour

Table 17 – Sulfur Dioxide Design Values 2015

Site	Design Values (SO ₂ PPB) Average of Years 2013-2015 1 Hour 99 th Percentile Daily Max
Rutland – 1 Hour	9
Underhill – 1 Hour	2*

- Design value for Underhill does not meet the EPA completeness criteria for all three years 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 discontinued or 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 / or NOy	Ozone	Sulfur Dioxide	Speciation (STN / IMPROVE)	BTEX	PM _{2.5} FRM	PM _{2.5} TEOM / BAM	PM ₁₀ FRM	PM Dichotomour	PM _{10-2.5} Subtraction	PM ₁₀ Low Volume/(metals)	VOC	Carbonyl	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Precipitation	Pressure	PAH
Bennington	Airport Road			✓				D	✓								✓	✓	✓	✓	✓	✓	✓	
Burlington	150 So Winooski Ave	✓	✓			P	✓		✓	P	D	P		✓	✓		✓	✓	✓	✓	✓	✓	✓	
Burlington	108 Cherry Street					D		D									D	D	D	D	D	D	D	
Dover ^{NFS}	Mount Snow ^{NFS}					✓																		
Rutland	Merchants Row	D	✓	✓*	✓			✓	✓	✓*	D	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Underhill	Harvey Road	✓T	✓T	✓	✓T	✓		✓	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓

P=Proposed T=Trace Level D=Discontinued *=New 4/2016 NFS= Operated by National Forest Service

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	PM _{10-2.5} Low Volume FEM	VOC (collocated)	Carbonyl (collocated)	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Precipitation	Pressure
Burlington	150 S. Winooski	✓	✓			P	✓	D	✓	P	D	✓	✓		✓	✓	✓	✓	✓	✓	✓

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 for trends analysis and subsequent metals analysis if feasible. 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.
- Scheduled for relocation ~2018 based on City of Burlington Planning Redevelopment Project

Figure 2 – Burlington Aerial Photo

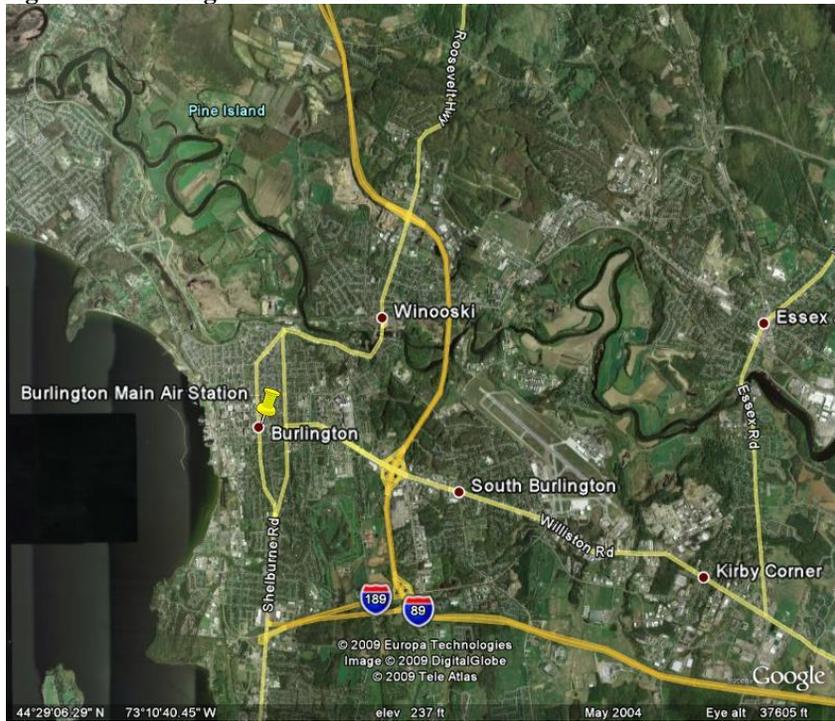


Figure 3 – Burlington Monitoring Shelter



Site Description: Burlington – 108 Cherry Street *DISCONTINUED* effective January 2017

Town – Site: **Burlington – Zampieri State Office Building**
 County: **Chittenden** Latitude: **+44.480278**
 Address: **108 Cherry St.** Longitude: **-73.214444**
 AQS Site ID: **50-007-0012** Elevation: **81.4 m**
 Spatial Scale: **Urban & Center City** Year Established: **1999**
 Statistical Area: **Burlington-South Burlington, VT Metropolitan**
Burlington-South Burlington, VT Metropolitan 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	Precipitation	Pressure
Burlington	108 Cherry St.					D		D							D	D	D	D	D	D	D

Site Description:

This site is located on the roof of the Zampieri State Office Building in Burlington. The monitoring site is located 15 meters above street level, .25 km from Lake Champlain, 1.2 km south west of McNeil Generating Station, 2.5 km west of I-89, and 8.5 km west of the Essex IBM plant. The site represents a neighborhood scale. 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 PM_{2.5}, is for compliance and trends analysis. Speciation monitoring objective is PM_{2.5} trends analysis and complimentary data for PM_{2.5} FRM data. The speciation sampling is conducted as part of the EPA Speciation Trends Network (STN). WS/WD & Temp/RH data is collected from a 3.0 meter tower.

Plans/History:

- Site established 1999
- Discontinued effective 2017, STN relocated to Burlington Main St.

Figure 4– Burlington Aerial Photo

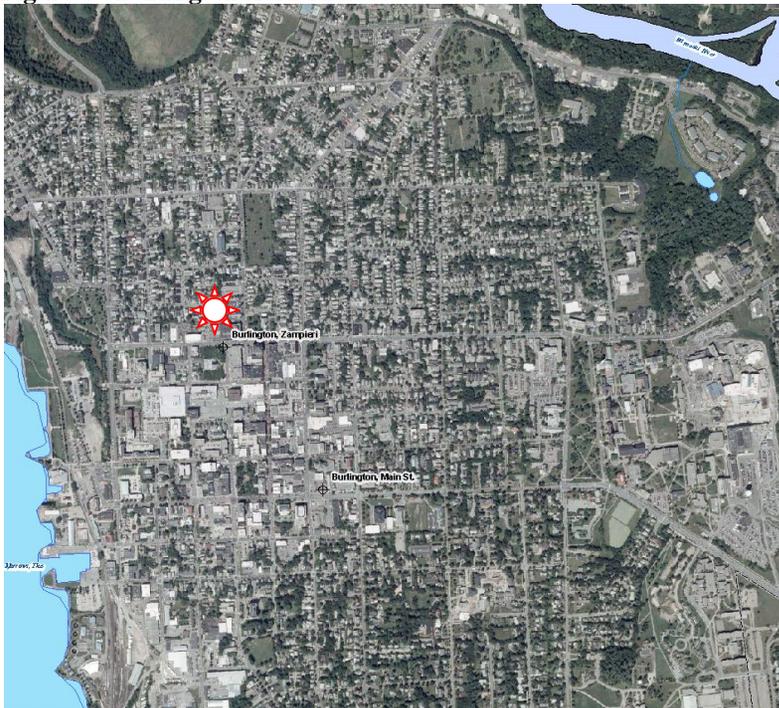
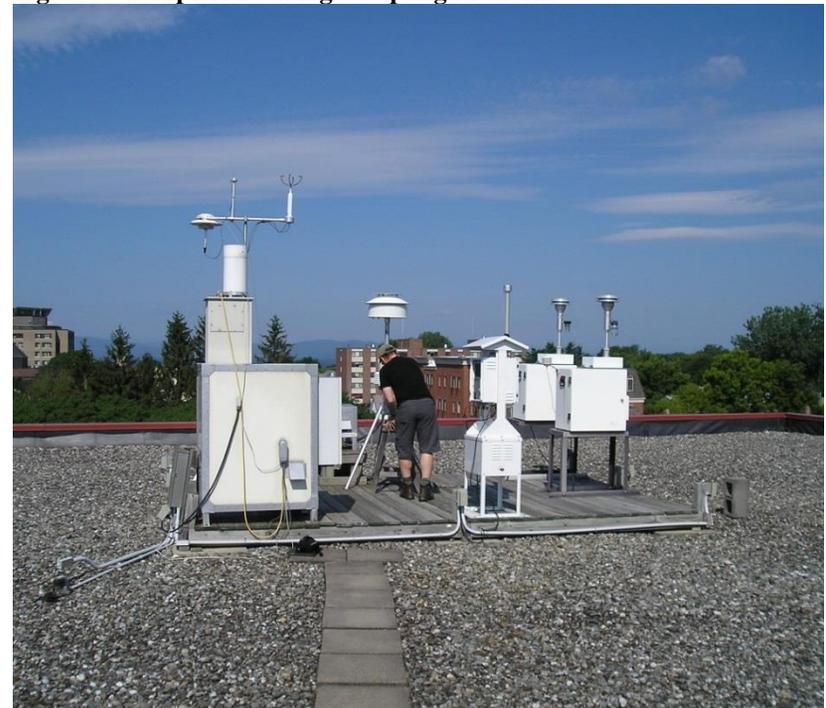


Figure 5- Zampieri Building Sampling Platform



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: **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	Precipitation	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 6 – Aerial View Mount Snow

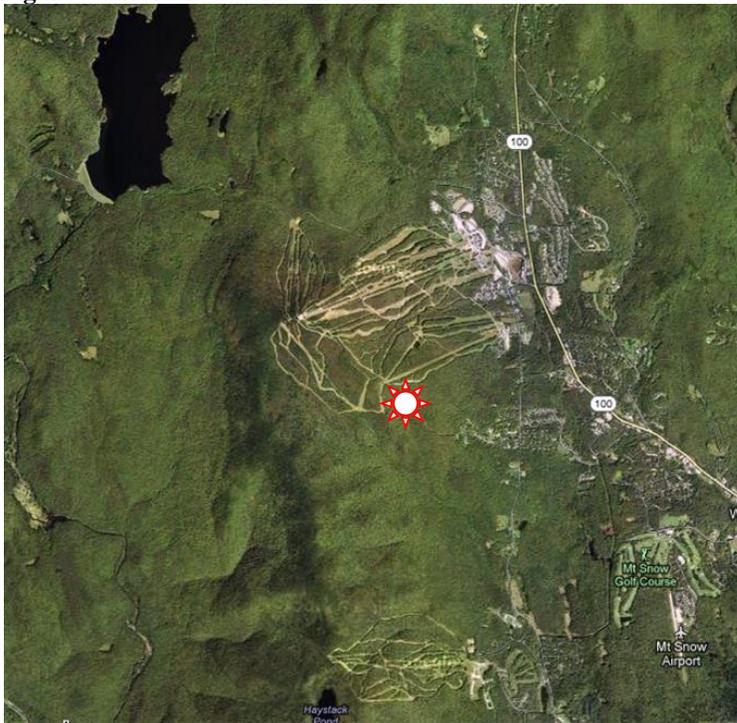


Figure 7 – View of Monitor Location



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	Precipitation	Pressure
Bennington	Airport Road			✓				D	✓						✓	✓	✓	✓	✓	✓	✓

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
- 2025 FRM discontinued April 11, 2016

Figure 8 – Aerial View Bennington

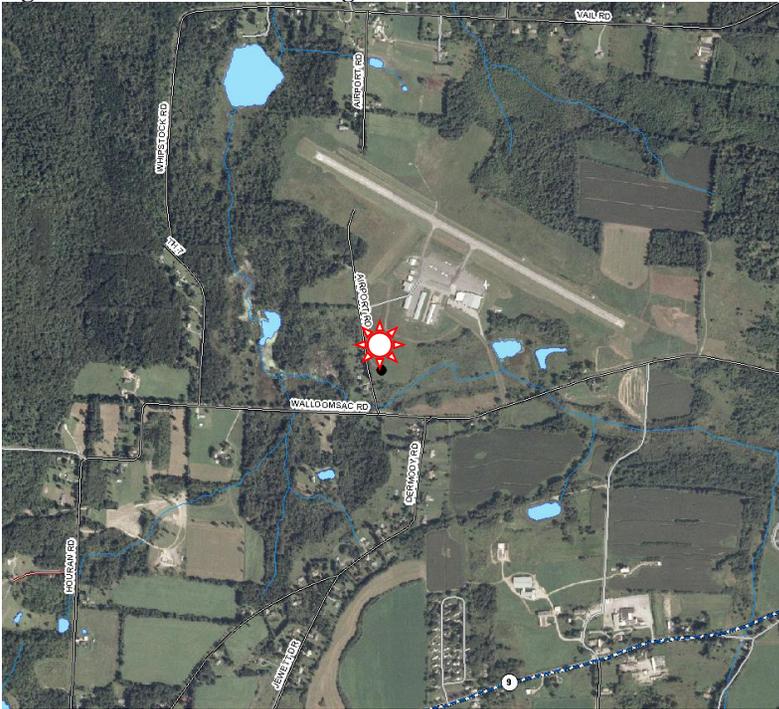


Figure 9 – Bennington Trailer



Site Description: Underhill – 58 Harvey Road

Town – Site: **Underhill – Proctor Maple Research Center**
County: **Chittenden** Latitude: **+44.528390**
Address: **58 Harvey Rd.** Longitude: **-72.868840**
AQS Site ID: **50-007-0007** Elevation: **392 m**
Spatial Scale: **Rural** Year Established: **1988**
Statistical Area: **Burlington-South Burlington, VT Metropolitan Area**
Burlington-South Burlington, VT Metropolitan 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 LV/ Metals	VOC		Carbonyl	PAH	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Precipitation	Pressure
Underhill	56 Harvey Rd.	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
<p>Site Description: This site is located at the western slope of Mount Mansfield at the north end Underhill, VT. The site is rural in nature and located 5 km south west of the summit of Mount Mansfield, 6 km south of Route 15, and 26 km east of Burlington. This monitoring location meets all siting requirements and criteria and has been approved by VTAQCD and EPA Region 1</p>																						
<p>General Monitoring Description & Objectives: The monitoring objective for ozone, PM_{2.5}, PM₁₀, PM speciation and future trace-level monitoring is regional scale background levels. The monitoring objectives for the VOC, Carbonyl , PAH, metals, and CR⁺⁶ sample collection and analysis are to assess background levels on a regional scale for short and long-term trends, comparison to applicable state standards and federal guidelines and assessment of contribution of transported pollutants. WS/WD & Temp/RH data is collected from a 10.0 meter tower.</p>																						
<p>Plans/History:</p> <ul style="list-style-type: none"> • Site Established 1988 • Began participation in NATTS 2004 • NCore upgrade CO, NOy, and SO₂ continuous monitoring started 4th Quarter 2010. 																						

Figure 10 – Aerial View Underhill

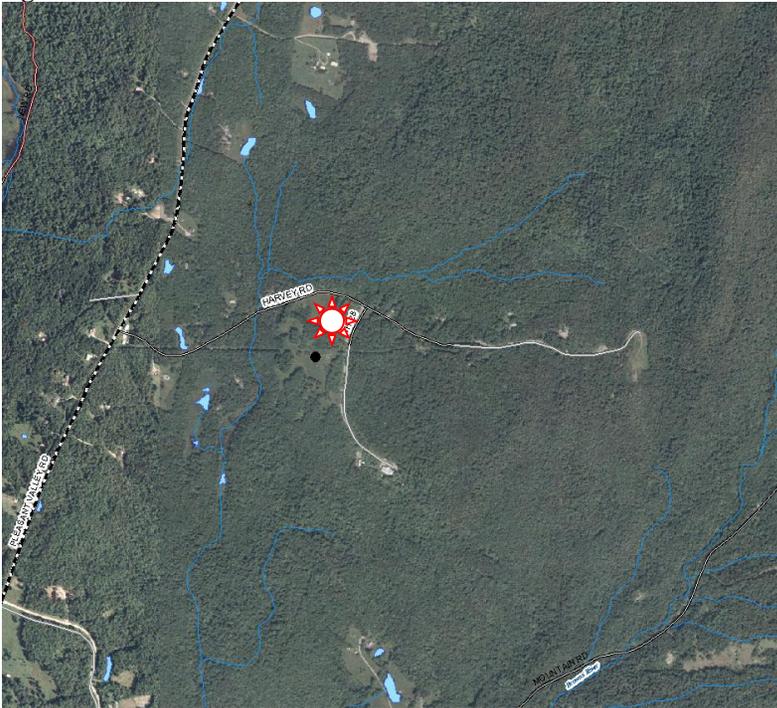


Figure 11 – Underhill IMROVE Shelter & Trailer



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 FRM	PM _{10-2.5} Low Volume	VOC	Carbonyl	Black Carbon	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Precipitation	Pressure
Rutland	96 State Street	D	✓	✓*	✓			✓	✓	✓	✓*	D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<p>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 USPS vehicles. This monitoring location meets all siting requirements and criteria and has been approved by VTAQCD and EPA Region 1.</p>																						
<p>General Monitoring Description & Objectives: The monitoring objective for CO, NO_x, 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.</p>																						
<p>Plans/History:</p> <ul style="list-style-type: none"> • Site Established 1971 • Fall 2012 replaced Wedding PM₁₀ with TEI 2025i Dichotomous (PM_{2.5} & PM_{10-2.5}) unit. • April 2016 TEI 2025iD Dichotomous discontinued • April 2016 Ozone and PM₁₀ FRM added 																						

*: New in 4/2016

Figure 12– Aerial View Rutland

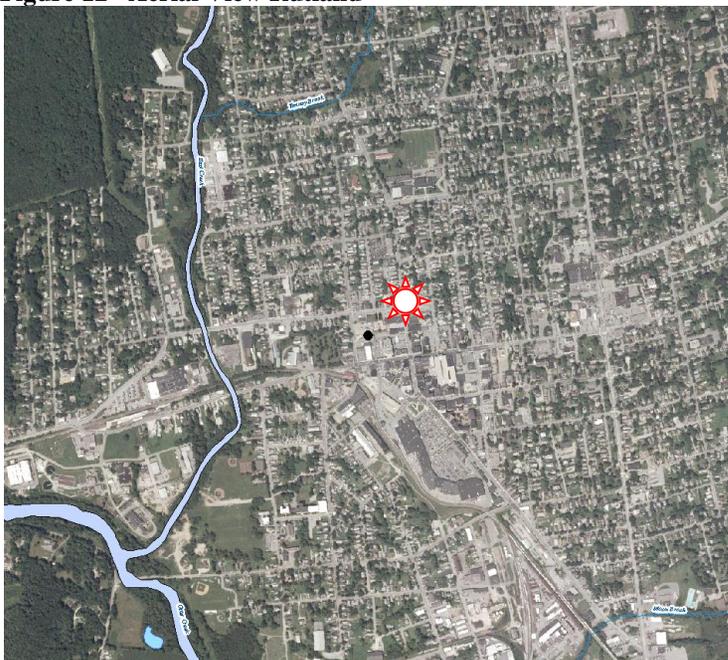


Figure 13 – Rutland Trailer



Appendix A – List of Analytes for Analytical Methods

Table 19 – Elemental Metals Analytes for PM10 (2015, 47 mm Teflon)

Metal	MDL (ng/m ³)*	Metal	MDL (ng/m ³)*
Antimony	0.056	Manganese	0.236
Arsenic	0.060	Molybdenum	0.017
Barium	0.141	Nickel	0.228
Beryllium	0.031	Selenium	0.625
Cadmium	0.009	Silver	0.010
Chromium	5.58	Strontium	0.216
Cobalt	0.016	Vanadium	0.016
Lead	0.165		

* assumes 24.0 m³

Table 20 – List of Analytes for Speciation Sampling

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

Table 21 – List of Carbonyl Analytes (2015)

Carbonyl Compound	VT DEC MDL (µg/m ³)*
Formaldehyde	0.014
Acetaldehyde	0.004
Acetone	0.024
Propionaldehyde	0.004

*: assumes 1.30 m³ total sample volume

Table 22 – Analyte List for VOC Analysis (2015)

VOC Compound	MDL (ppb)
1,1,1-Trichloroethane	0.006
1,1,2,2-Tetrachloroethane	0.016
1,1,2-Trichloroethane	0.006
1,1-Dichloroethane	0.007
1,1-Dichloroethene	0.008
1,2,4-Trichlorobenzene	0.086
1,2,4-Trimethylbenzene	0.024
1,2-Dibromoethane	0.007
1,2-Dichloroethane	0.008
1,2-Dichloropropane	0.008
1,3,5-Trimethylbenzene	0.021
1,3-Butadiene	0.008
3-Chloropropene	0.009
Acrolein*	0.030
Acrylonitrile	0.011
Benzene	0.008
Bromochloromethane	0.007
Bromodichloromethane	0.006
Bromoform	0.008
Bromomethane	0.005
Carbon Tetrachloride	0.005
Chlorobenzene	0.010
Chloroethane	0.007
Chloroform	0.006
Chloromethane	0.006
Chloroprene	0.007
cis-1,2-Dichloroethylene	0.007
cis-1,3-Dichloropropene	0.007

VOC Compound	MDL (ppb)
Dibromochloromethane	0.005
Dichlorodifluoromethane	0.010
Dichlorotetrafluoroethane	0.013
Ethyl Acrylate	0.010
Ethyl tert-Butyl Ether	0.006
Ethylbenzene	0.007
Hexachloro-1,3-butadiene	0.105
m,p-Xylene	0.009
m-Dichlorobenzene	0.028
Methyl Isobutyl Ketone	0.008
Methyl Methacrylate	0.008
Methyl tert-Butyl Ether	0.008
Methylene Chloride	0.007
n-Octane	0.005
o-Dichlorobenzene	0.029
o-Xylene	0.010
p- Dichlorobenzene	0.029
Styrene	0.014
tert-Amyl Methyl Ether	0.007
Tetrachloroethylene	0.006
Toluene	0.007
trans-1,2-Dichloroethylene	0.008
trans-1,3-Dichloropropene	0.008
Trichloroethylene	0.007
Trichlorofluoromethane	0.004
Trichlorotrifluoroethane	0.008
Vinyl Chloride	0.006

*EPA is continuing to evaluate analytical method for the compound - Acrolein.

Table 23 – Analyte List for PAH Analysis (ERG: 2015)

PAH Compounds	ng/m³
9-Fluorenone	0.132
Acenaphthene	0.082
Acenaphthylene	0.067
Anthracene	0.072
Benzo (a) anthracene	0.082
Benzo (a) pyrene	0.132
Benzo (b) fluoranthene	0.092
Benzo (e) pyrene	0.096
Benzo (g,h,i) perylene	0.068
Benzo (k) fluoranthene	0.098
Chrysene	0.069
Coronene	0.095
Cyclopenta[cd]pyrene	0.125
Dibenz (a,h)anthracene	0.089
Fluoranthene	0.098
Fluorene	0.189
Indeno(1,2,3-cd)pyrene	0.083
Naphthalene	0.166
Perylene	0.065
Phenanthrene	0.156
Pyrene	0.09
Retene	0.093

Appendix B – National Ambient Air Quality Standards As of May 2016

Pollutant [links to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 µg/m ³ ⁽¹⁾	Not to be exceeded
Nitrogen Dioxide (NO₂)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb ⁽²⁾	Annual Mean
Ozone (O₃)		primary and secondary	8 hours	0.070 ppm ⁽³⁾	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	PM _{2.5}	primary	1 year	12.0 µg/m ³	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m ³	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 µg/m ³	98th percentile, averaged over 3 years
	PM ₁₀	primary and secondary	24 hours	150 µg/m ³	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO₂)		primary	1 hour	75 ppb ⁽⁴⁾	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m³ as a calendar quarter average) also remain in effect.

(2) The level of the annual NO₂ standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O₃ standards additionally remain in effect in some areas. Revocation of the previous (2008) O₃ standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO₂ standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO₂ standards or is not meeting the requirements of a SIP call under the previous SO₂ standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the require NAAQS.

*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) October 1, 2011 <http://epa.gov/air/criteria.html>
2. State of Vermont, Agency of Natural Resources, *Air Pollution Control Regulation; Appendix C*, http://dec.vermont.gov/sites/dec/files/aqc/laws-regs/documents/AQCD_Regulations_2014-12-29.pdf
3. United States Environmental Protection Agency, Technology Transfer Network, Ambient Monitoring Technology Information Center – *List of Designated EPA Reference and Equivalent Methods* Dec 18, 2014 <http://www.epa.gov/ttn/amtic/criteria.html>
4. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 50, Protection of Environment, May 20, 2016.](#)
5. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 53, Protection of Environment, May 20, 2016.](#)
6. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 58, Protection of Environment, May 20, 2016.](#)