

Vermont National Core (NCore) Monitoring Work Plan 2009



Vermont Department of Environmental Conservation
Air Pollution Control Division
July 10, 2009

Table of Contents

Section	Page Number
Table of Contents	2
List of Figure.....	3
List of Tables	4
Acronyms and Abbreviations	5
EPA NCore Program Background	6
NCore Monitoring Objectives.....	6
The NCore network will address the following objectives:.....	6
Vermont NCore Air Monitoring Site Overview	7
Area of Representativeness:.....	7
NCore Pollutant Monitoring Descriptions	12
NCore PM _{2.5} FRM Monitoring Network	12
NCore PM _{2.5} Speciation Monitoring Network.....	13
NCore Continuous PM _{2.5} Monitoring Network	13
NCore Ozone Monitoring Network	14
NCore Ambient Air Toxics Monitoring Network	14
NCore PM ₁₀ Monitoring Network	15
NCore Trace Level Total Reactive Nitrogen Monitoring (New Summer 2009).....	16
NCore Trace Level Carbon Monoxide Monitoring (New Summer 2009)	16
NCore Trace Level Sulfur Dioxide Monitoring Network (New Summer 2009).....	16
NCore Trace Level Blender/Zero Air System (New Summer 2009)	17
NCore Meteorological Measurements	17
Site Description: Underhill – 58 Harvey Road	19
General References	24

List of Figure

Figure ID	Page Number
Figure 1 - Vermont Town & County Boundaries	10
Figure 2 - 2009 Vermont NCore Site Map	11
Figure 4 - Aerial View Underhill.....	21
Figure 5 - General Site View	21
Figure 6 – Current Interior Shelter Setup	22
Figure 7 - Underhill Installed 10 Meter NOy Tower.....	22
Figure 8 - Directional Views from Roof of Trailer.....	23

List of Tables

Table ID	Page Number
Table 1 - Spatial Representations	8
Table 2 - Monitored Pollutants & Parameters	12
Table 3 – PM _{2.5} Sample/Analysis Method.....	12
Table 4 – Speciation Sample/Analysis Method.....	13
Table 5 - Continuous PM _{2.5} Method	13
Table 6 - Ozone Monitoring Method.....	14
Table 7 - 2006- 2008 Ozone Design Value - Underhill, VT	14
Table 8 – NCore Ambient Air Toxic Sampling/Analysis Methods.....	15
Table 9 – PM ₁₀ Sample/Analysis Method	15
Table 10 – Nitrogen Dioxide Monitoring Method.....	16
Table 11– Carbon Monoxide Monitoring Method.....	16
Table 12– Sulfur Dioxide Monitoring Method.....	17
Table 13 - Trace Level Blender	17
Table 14 – Meteorological Measurements.....	17

Acronyms and Abbreviations

AMTIC - Ambient Monitoring Technical Information Center
APCD - (Vermont) Air Pollution Control Division
AQI - Air Quality Index
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
IMPROVE - Interagency Monitoring of Protected Visual Environments
IO - inorganic
MQOs - measurement quality objectives
MPA - monitoring planning area
MSA - metropolitan statistical area
NAAQS - National Ambient Air Quality Standards
NADP - National Atmospheric Deposition Program
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
PESA - Proton-Elastic Scattering Analysis
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 APCD
VOC - volatile organic compound
XRF - X-Ray fluorescence

EPA NCore Program Background

In October 2006 the United States Environmental Protection Agency (EPA) issued final amendments to the ambient air monitoring regulations for criteria pollutants. These amendments are codified in 40 CFR parts 53 and 58. The purpose of the amendments was to enhance ambient air quality monitoring to better serve current and future air quality needs. One of the most significant changes in the regulations was the requirement to establish National Core (NCore) multi-pollutant monitoring stations. These stations will provide data on several pollutants at lower detection limits and replace the National Air Monitoring Station (NAMS) networks that have existed for several years. The final network plan must be submitted to EPA by July 1, 2009 and the stations must be operational by January 1, 2011.

A new national monitoring network design (called NCore) should accommodate these recommendations and the major demands of air monitoring networks, such as:

- trend determinations
- reporting to the public
- assessing the effectiveness of emission reduction strategies
- providing data for health assessments and NAAQS review
- determinations of attainment and nonattainment status.

The network modifications, including NCore, should be conducted within current resource allocations used to support monitoring (e.g., with respect to staffing). However, there needs to be modest investments in new equipment to upgrade monitoring systems to meet new priorities and accommodate advanced technologies.

NCore Monitoring Objectives¹

The NCore network will address the following objectives:

- Timely reporting of data to public by supporting AIRNow, air quality forecasting, and other public reporting mechanisms;
- Support for development of emission strategies through air quality model evaluation and other observational methods;
- Accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors;
- Support for long-term health assessments that contribute to ongoing reviews of the NAAQS;
- Compliance through establishing nonattainment/attainment areas through comparison with the NAAQS;

¹ Website <http://www.epa.gov/ttn/amtic/ncore/index.html>

-
- Support to scientific studies ranging across technological, health, and atmospheric process disciplines; and
 - Support to ecosystem assessments recognizing that national air quality networks benefit ecosystem assessments and, in turn, benefit from data specifically designed for address ecosystem analyses.

Vermont NCore Air Monitoring Site Overview

The Underhill, Vermont monitoring site (AQS ID Code 500070007) has been designated as the NCore monitoring site for Vermont. The site is located at the Proctor Maple Research Center (PMRC), which is owned and operated by the University of Vermont. The air monitoring site was originally established in 1983. The site was upgraded in 1989 with a new trailer, and continuous ozone monitoring. The Interagency Monitoring of Protected Visual Environments ([IMPROVE](#)) site was established in 1988 and was upgraded in 2003. The site became a National Air Toxics Trends Site ([NATTS](#)) in 2004. The site is also a part of the National Atmospheric Deposition Program ([NADP/MDN](#)) operated cooperatively by University of VT and Ecosystems Research Group, LTD. That effort has been on-going since 1984.

The monitoring site is characterized as an open sloping field surrounded by the densely forested western slope of Mount Mansfield. The is part of the Burlington-South Burlington - Core Base Statistical Area (CBSA) and approximately 26 km east of downtown Burlington, VT. The 5 km surrounding area includes farms, residential homes, state park, and a maple forest research laboratory. The site is rural in nature and located south west of the summit of Mount Mansfield. This monitoring location meets all siting requirements and criteria and has been approved by VTAPCD and EPA Region 1

The Underhill site was selected due to the needs of the NCore program for a well establish background trends site. The Underhill site has a well establish SLAMS Criteria (PM_{2.5}, Ozone) NATTS – monitoring for atmospheric VOC, Carbonyl, PAH, Metals and an IMPROVE monitors for speciated particulate.

Area of Representativeness:

[40 CFR Part 58 Appendix D](#)² provides design criteria for ambient air monitoring. The Underhill monitoring objective for the NCore site is to produce data that represents a fairly large area and therefore the spatial scale of the site is important. Underhill has been designated as a rural NCore monitoring site.

- Each State (i.e. the fifty States, District of Columbia, Puerto Rico, and the Virgin Islands) is required to operate at least one NCore site.

² [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 58, Protection of Environment, June 6, 2008.](#)

- Rural NCore stations are to be located to the maximum extent practicable at a regional or larger scale away from any large local emission source, so that they represent ambient concentrations over an extensive area.
- The NCore sites must measure, at a minimum, PM_{2.5} particle mass using continuous and integrated/filter-based samplers, speciated PM_{2.5}, PM_{10-2.5} particle mass, speciated PM_{10-2.5}, O₃, SO₂, CO, NO/NO_y, wind speed, wind direction, relative humidity, and ambient temperature. Although the measurement of NO_y is required in support of a number of monitoring objectives, available commercial instruments may indicate little difference in their measurement of NO_y compared to the conventional measurement of NO_x, particularly in areas with relatively fresh sources of nitrogen emissions. Therefore, in areas with negligible expected difference between NO_y and NO_x measured concentrations, the Administrator may allow for waivers that permit NO_x monitoring to be substituted for the required NO_y monitoring at applicable NCore sites.

Regional scale —Defines usually a rural area of reasonably homogeneous geography without large sources, and extends from tens to hundreds of kilometers.

Table 1 - Spatial Representations

Pollutant	Spatial Scale	Comments
Ozone	Regional	Commenced in 1989
NO _y -TL	Regional	Scheduled for summer 2009
CO - TL	Regional	Scheduled for summer 2009
SO ₂ - TL	Regional	Scheduled for summer 2009
PM ₁₀ – (Metals)	Regional	Commenced in 2004
PM ₁₀ -Lo-Vol	Regional	Commenced in 2007
PM _{2.5}	Regional	1999-2002 & Restarted 2007
VOC	Regional	Commenced in 2004
Carbonyl	Regional	Commenced in 2004
PAH	Regional	Commenced in 2008
IMPROVE	Regional	Commenced in 2003
NADP/MDN ³	Regional	Commenced in 1984

Quality Assurance Project Plans

The Vermont APCD and partnering organizations will utilize current operational quality assurance project plans that are approved or in the process of approval for the NCore site. These documents provide the background that will guide the operational, data analysis, and reporting activities. Currently equipment SOP's data acquisition, and data validation methods are being developed for trace level continuous methods prior to field deployment.

³ Mercury Deposition Network station operated by University of Vermont and participating organizations.

-
- Quality Assurance Project Plan For The Air Toxics Monitoring and National Air Toxics Trends Station Networks – Rev 2.2 December 30, 2008
 - Vermont PM2.5 Quality Assurance Project Plan – Rev 2.2 February 6, 2008
 - Quality Assurance Project Plan For Criteria Pollutant – Rev 2.0 May 2, 2007⁴
 - IMPROVE: Interagency Monitoring of Protected Visual Environments Quality Assurance Project Plan OAQPS Category 1 QAPP Rev 0.0 March 2002
 - NADP Quality Management Plan - Ver. 1.0; December 2003

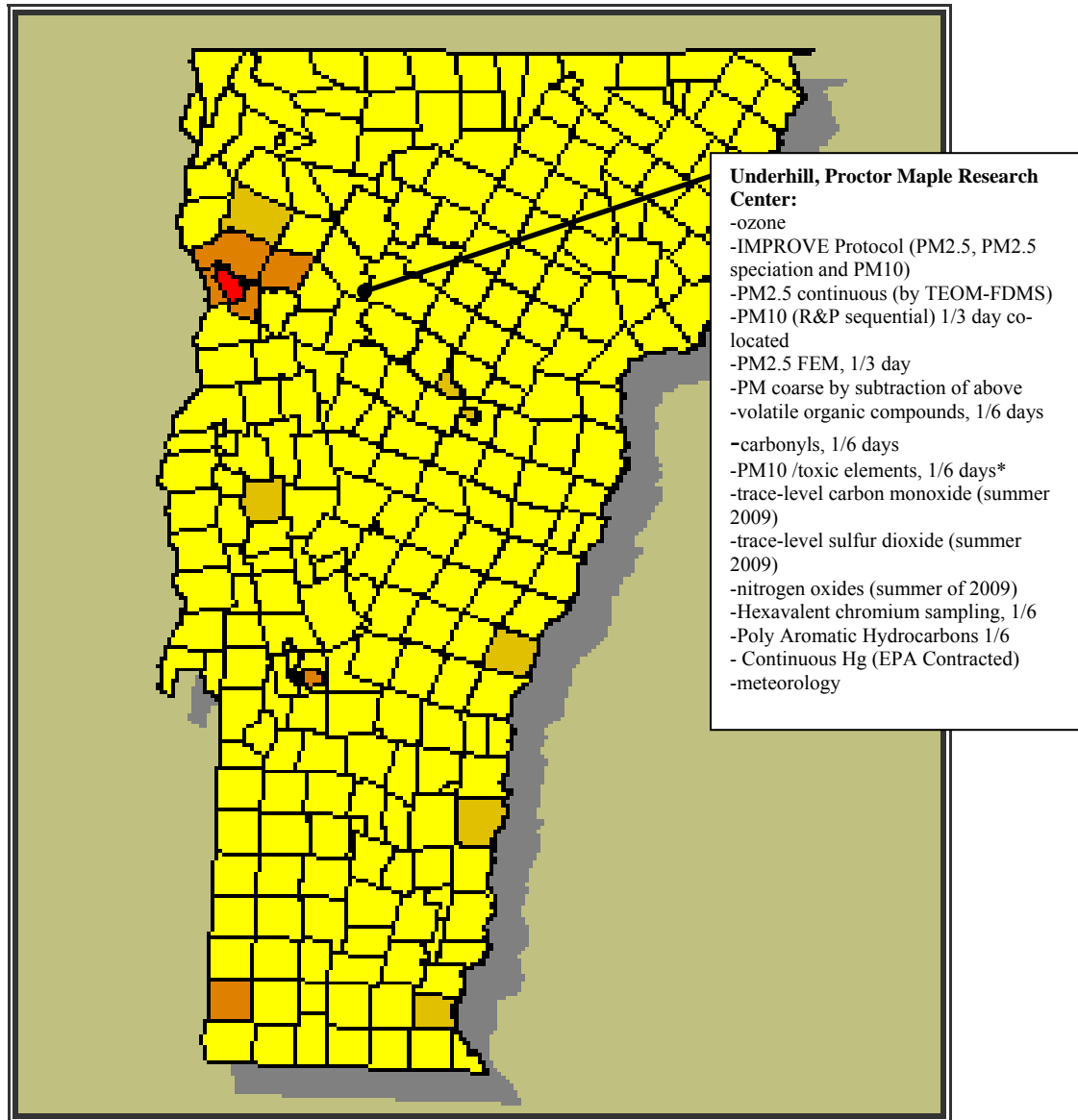
⁴ Quality Assurance Plan for Criteria Pollutants has conditional EPA Region 1 approval with outstanding SOP's and meteorological section. Planned completion – July 2009

Figure 1 - Vermont Town & County Boundaries



Figure 2 - 2009 Vermont NCore Site Map

2009 Vermont NCore Air Monitoring Site



NCore Pollutant Monitoring Descriptions

Below is the list of network pollutant monitoring descriptions at the Underhill NCore monitoring site. The sampling frequency, and specific network information.

Table 2 - Monitored Pollutants & Parameters

Parameter	Comments
PM _{2.5} speciation	Organic and elemental carbon, major ions and trace metals (24 hour average; every 3rd day)
PM _{2.5} FRM mass	24 hr. average every 3rd day
PM ₁₀ Hi Volume & Metals	24 hr average every 6 th day – metals analysis on sample
continuous PM _{2.5} mass	1 hour reporting interval for all cont. species
ozone (O3)	all gases through cont. monitors (except HNO3 and NH3)
carbon monoxide trace level (CO)	capable of trace levels (low ppb and below) where needed
sulfur dioxide trace level (SO2)	capable of trace levels (low ppb and below) where needed
nitrogen oxide trace level (NO)	capable of trace levels (low ppb and below) where needed
total reactive nitrogen trace level (NOy)	capable of trace levels (low ppb and below) where needed
surface meteorology	wind speed and direction, temperature, RH, Baro, Solar, Precip

NCore PM_{2.5} FRM Monitoring Network

The Underhill PM_{2.5} FRM is one of four FRM sites in the state of Vermont. The other monitoring locations are in Burlington, Bennington, Rutland. 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 3). 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 3 – 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} are 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. The Underhill FRM sampler was restarted in 2007 and does not currently have three years of continuous data from this location as required to calculate the design value.

NCore PM_{2.5} Speciation Monitoring Network

Underhill has an established Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring site that was originally established in 1986. The sampler operates on a 1-in-3 day schedule and produce a 24 hour integrated filter based sample. The Underhill site part of the IMPROVE network. There is another Vermont IMPROVE site at the in Manchester, Lye-Brook Wilderness which is operated and maintained by the National Forest Service and is not part of the Vermont APCD 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 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.

Table 4 – Speciation Sample/Analysis Method

Pollutant	Sampler	Collection	Analytical Method	Analytes /Lab
PM Speciation (IMPROVE)	UCDavis – IMPROVE Sampler	Low Volume Multi Filter - 24 Hour	IMPROVE	See Appendix A/UCDavis

NCore Continuous PM_{2.5} Monitoring Network

The Underhill is one of four continuous PM_{2.5} sites operated in the state of Vermont. The R&P Model 8500 FDMS TEOM are also operated at the Bennington, Burlington, and Rutland sites. All continuous PM_{2.5} samplers are operated year-round and have a collocated PM_{2.5} FRM sampler for comparative analysis. Data is reported to 1-hour and 24-hour averaging periods. The data is currently used for PM_{2.5} AQI determination and trends analysis.

Table 5 - Continuous PM_{2.5} Method

Pollutant	Sampler	Collection	Analytical Method	Reported Data Interval
PM _{2.5}	R&P Model 8500 FDMS TEOM	Low Volume Filter/ microbalance	Continuous gravimetric	1 Hour

NCore Ozone Monitoring Network

The Underhill ozone monitor is one of two ozone sites in the State of Vermont air monitoring network. Both ozone analyzers are operated year-round. Data is collected on an hourly basis. Data resolution is store in 1 minute, 5 minute, 1 hour, and 8 hour averaging intervals. Ozone measurements are utilized to determine compliance with 1 hour and 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 operational 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 6 - 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 (2006-2008)

Below are the current design values for ozone from 2006-2008 (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 8-hour ozone standard is 0.075 ppm. Currently, all Vermont monitors are in attainment for ozone.

Table 7 - 2006- 2008 Ozone Design Value - Underhill, VT

Site	Design Value (ppm)
Underhill	.070

NCore Ambient Air Toxics Monitoring Network

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

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) and Polyaromatic Hydrocarbons (PAH) compounds.

Table 8 – NCore Ambient Air Toxic Sampling/Analysis Methods

Pollutant	Sampler	Collection	Analytical Method	Analytes/Lab
VOC	ATEC 301	6 Liter SS Canister- 24 Hour	TO-15	56 VOC Compounds ERG
Carbonyl	ATEC 300	DNPH Cartridge- 24 Hour	TO-11A	4 Carbonyl Compounds VTDEC and/or ERG
Metals	Wedding 1000	Quartz Fiber Filter- 24 Hour	IO-3.5	11 Elements ERG and/or VT DEC
PAH	Tisch TE-1000	PUF/XAD- 24 Hour	TO-13	22 PAH Compounds ERG
Hexavalent Chromium	VT APCD Cr+6 Sampler (based on ERG design)	Cellulose Filter- 24 Hour	Modified CARB 039	1 Element ERG

NCore PM₁₀ Monitoring Network

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.

In addition to Vermont low-volume PM₁₀ sampling, APCD also operates high volume 24 hr sample collection on an 8”x10” quartz fiber filter on a 1-6 day schedule. 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. When the gravimetric determination is completed, the glass fiber filters are processed and analyzed for elemental metals.

Table 9 – PM₁₀ Sample/Analysis Method

Pollutant	Sampler	Collection	Analytical Method	Analytes /Lab
PM ₁₀	Wedding 1000 Reference Method: RFPS-1087-062	Hi Volume 8x10 Quartz fiber 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

NCore Trace Level Total Reactive Nitrogen Monitoring (New Summer 2009)

The total reactive nitrogen oxides analyzer (NO_y) sampler will be operated year-round. The proposed plan calls for NO_y trace level (TL) measurements to commence in Underhill for summer 2009. The Ecotech EC9841 Total Reactive Nitrogen Oxides Analyzer utilizes chemiluminescence detection to measure NO and NO_y in the ranges of 0-2000 ppb with a detection limit of 50 ppt or .050 ppm.

Table 10 – Nitrogen Dioxide Monitoring Method

Pollutant	Sampler	Collection	Analytical Method	Reported Data Interval
NO _y (TL)	Ecotech EC9841T Automated Reference Method: RFNA-1292-090	Continuous sampling	Chemiluminescence	1 Hour

NCore Trace Level Carbon Monoxide Monitoring (New Summer 2009)

Trace-level (TL) carbon monoxide will be monitored in Underhill. The Ecotech EC9830 will be utilized for monitoring. Detection of sub-ambient levels of CO is made challenging due to interference by H₂O and CO₂. The use of gas filter correlation technology minimizes this interference and enables the instrument to measure CO in ambient air in the range of 0-20,000 ppb with a estimated detection limit of 25 ppb.

Table 11– Carbon Monoxide Monitoring Method

Pollutant	Sampler	Collection	Analytical Method	Reported Data Interval
Carbon Monoxide (TL)	Ecotech EC9830 Automated Reference Method: RFCA-0992-088	Continuous sampling	Infra-red	1 Hour

NCore Trace Level Sulfur Dioxide Monitoring Network (New Summer 2009)

The Vermont APCD will operate trace level sulfur dioxide (SO₂) analyzer, located at the in Underhill by summer 2009. The Thermo Environmental Instruments Model 43C TL trace level unit utilizes the pulsing of the U.V. source lamps to increase the optical intensity whereby a greater U.V. energy throughput and lower detectable SO₂ concentration are realized. Trace level SO₂ detection limits are estimated to be 0.05 ppb.

Table 12– 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 Florescence	1 Hour

NCore Trace Level Blender/Zero Air System (New Summer 2009)

The APCD will operate the API Model 700/701 system as the station multi-gas blender/zero air system. The unit will operate trace level multi-gas blender to deliver accurate low level concentrations to the CO, NO_y, O₃, SO₂ units to a parts per trillion (PPT) input level. Unit will be deployed to the monitoring site by summer of 2009.

Table 13 - Trace Level Blender

Operation	Model	Flow Range	O ₃ Transfer Std	Certification Schedule MFC/O ₃
Multi-Gas Blending System	APT 700– TL API 701 HF	MFC 1- 0-10 cc/min MFC 2- 0-100 cc/min MFC 3- 0-20 l/min	Yes	90 days

NCore Meteorological Measurements

The APCD currently operates the Met One meteorological system on a 10 meter tower. Parameters include wind speed, wind direction, relative humidity, temperature, barometric pressure, solar radiation, and precipitation. Quarterly sensor checks are performed to assure sensors are performing within specifications.

The quality assurance project plan for meteorological monitoring is pending and will be submitted to EPA NE by the fall 2009.

Table 14 – Meteorological Measurements

Operation	Model	Units	Data Reporting Interval	Data Acquisition
Wind Speed	Ultrasonic	M/S	1min, 15,min, 1hr	Data logger
Wind Direction	Ultrasonic	Deg	1min, 15,min, 1hr	Data logger

Operation	Model	Units	Data Reporting Interval	Data Acquisition
Temperature	Thermistor	Deg. C	1min, 15,min, 1hr	Data logger
Relative Humidity	Di-electric Polymer	% H ₂ O	1min, 15,min, 1hr	Data logger
Solar Radiation	Differential Thermopile	Watts/m ²	1min, 15,min, 1hr	Data logger
Precipitation	Tipping Gauge	Inches	1min, 15,min, 1hr	Data logger
Barometric Pressure	Pressure Transducer	mmHg	1min, 15,min, 1hr	Data logger

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 Oxides	Ozone	Sulfur Dioxide	Speciation (STN)	Speciation (IMPROVE)	PM _{2.5} FRM	PM _{2.5} TEOM	PM ₁₀ FRM	PM ₁₀ Low Volume	VOC	Carbonyl	PAH	Wind Speed	Wind Direction	Temperature	Relative Humidity	Solar Radiation	Precipitation	Pressure	
Underhill	56 Harvey Rd.	PT	PT	✓	PT		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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 VTAPCD and EPA Region 1

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.

Plans/History:

- Site Established 1988

P = Planned startup 2008 T = Trace Level

Figure 3 Regional Satellite Map

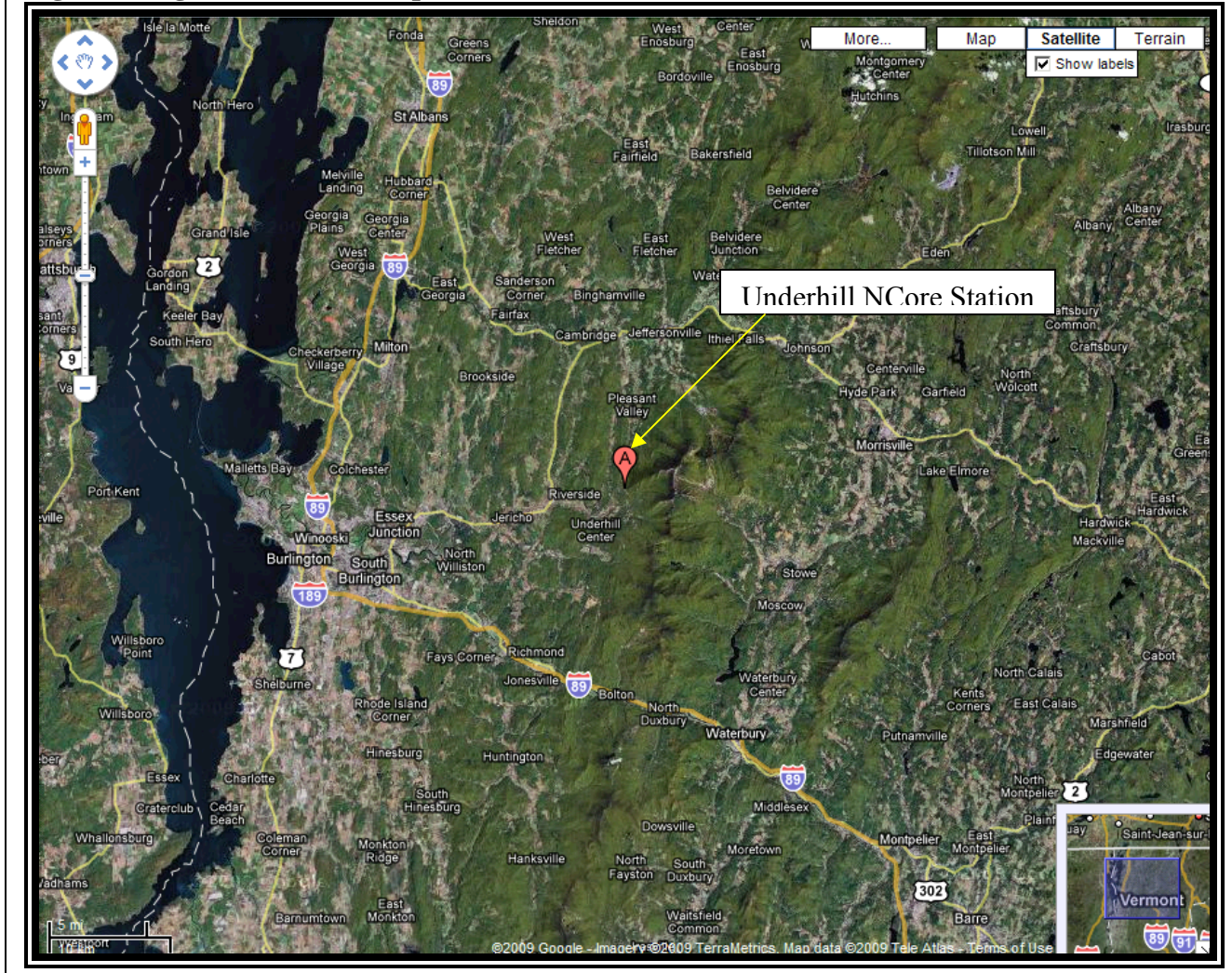


Figure 4 - Aerial View Underhill

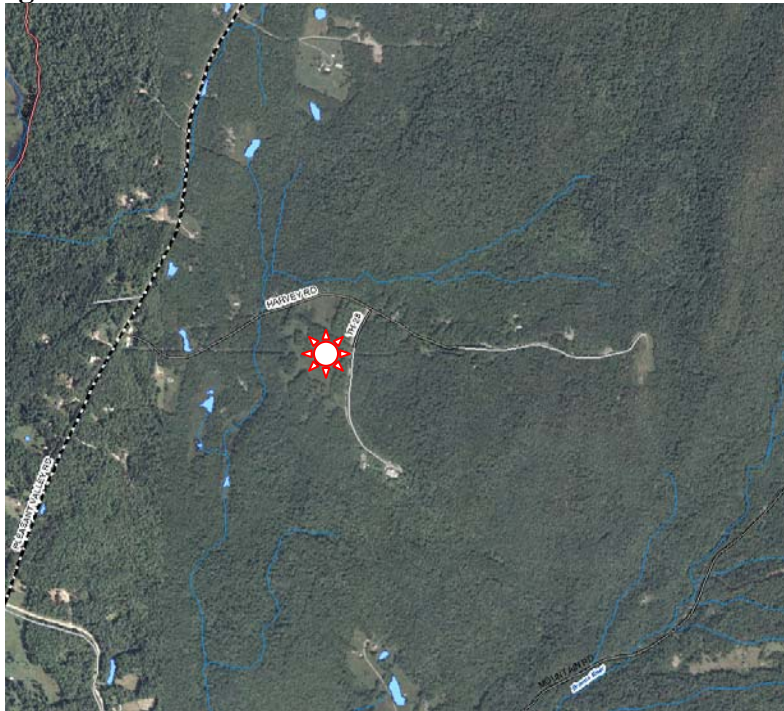


Figure 5 - General Site View



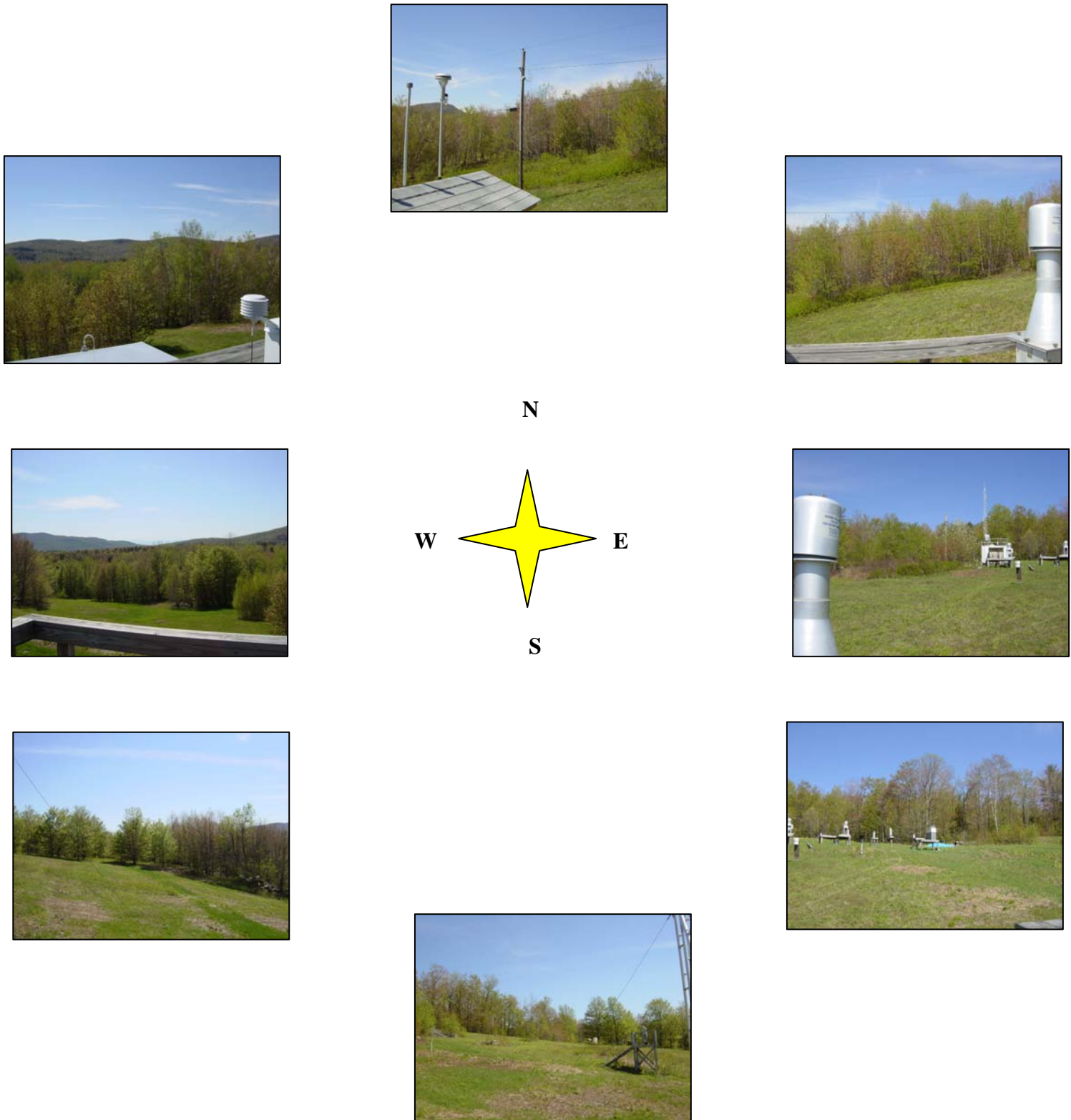
Figure 6 – Current Interior Shelter Setup



Figure 7 - Underhill Installed 10 Meter NOy Tower



Figure 8 - Directional Views from Roof of Trailer



General 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*, December 31, 2003
3. Electronic Code of Federal Regulations (e-CFR) Part 58 Subpart B § 58.10 <http://www.gpoaccess.gov/cfr/index.html>
4. United States Environmental Protection Agency, Technology Transfer Network, Ambient Monitoring Technology Information Center – *List of Designated EPA Reference and Equivalent Methods* May 16, 2007 <http://www.epa.gov/ttn/amtic/criteria.html>
5. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 50, Protection of Environment, June 6, 2008.](#)
6. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 53, Protection of Environment, June 6, 2008.](#)
7. [Code of Federal Regulation, \(e-CFR\) 40 CFR Part 58, Protection of Environment, June 6, 2008.](#)
8. Draft - Ambient Air Monitoring Work plan For National Core (NCore) Monitoring Station CBSA Louisville-Jefferson County , Louisville Metro Air Pollution Control District - 2009