Appendix B

National Core (NCore) Multi-pollutant Monitoring

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Background

In October 2006, the United States Environmental Protection Agency (EPA) established the National Core (NCore) multi-pollutant monitoring network in its final amendments to the ambient air monitoring regulations for criteria pollutants (codified in 40 CFR parts 53 and 58). It is the expectation that each state will have at least one NCore site. Nationwide, approximately 50 sites will be located in urban locations and 20 sites in rural areas. The multi-pollutant monitoring approach at NCore sites will benefit health assessments, emissions strategy development, and future monitoring efforts. By providing data users, such as researchers and policy makers, with a robust suite of collocated pollutant and meteorological data, NCore sites will better characterize the numerous chemical and physical interactions between pollutants than what is traditionally available at compliance oriented monitoring sites.

The NCore Monitoring Network addresses the following monitoring objectives which are equally valued at each site:

- timely reporting of data to the public through AIRNow, air quality forecasting, and other public reporting mechanisms;
- support 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 long-term health assessments that contribute to ongoing reviews of the National Ambient Air Quality Standards (NAAQS);
- compliance through establishing nonattainment/attainment areas by comparison with the NAAQS;
- support of scientific studies ranging across technological, health, and atmospheric process disciplines; and
- support of ecosystem assessments, recognizing that national air quality networks benefit ecosystem assessments and, in turn, benefit from data specifically designed to address ecosystem analysis.

At a minimum NCore monitoring sites must measure the parameters listed in Table B-1.

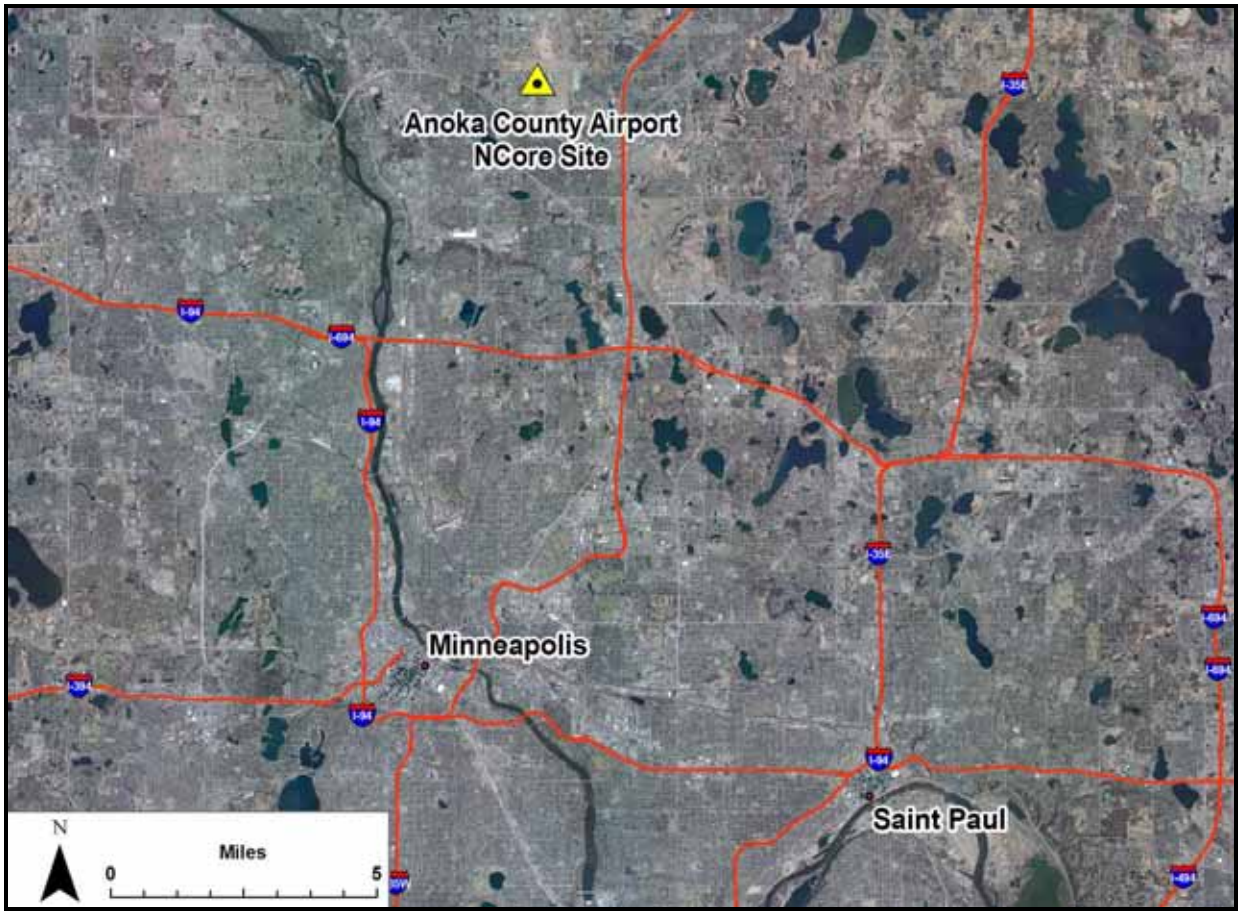
Table B-1: Required NCore parameter list

Parameter	Comments
$PM_{2.5}$ FRM mass	24-hour average every third day
continuous $PM_{2.5}$ mass	one hour reporting interval
continuous $PM_{(10-2.5)}$ mass	in anticipation of a $PM_{(10-2.5)}$ standard
ozone (O_3)	continuous monitor consistent with other O_3 sites
carbon monoxide (CO)	continuous monitor consistent with other CO sites
carbon monoxide (CO) trace level	continuous monitor capable of trace levels (low ppb and below)
sulfur dioxide (SO_2)	continuous monitor consistent with other SO_2 sites
sulfur dioxide (SO_2) trace level	continuous monitor capable of trace levels (low ppb and below)
oxides of nitrogen (NO_X)	continuous monitor consistent with other NO_X sites
total reactive nitrogen (NO/NO_y)	continuous monitor capable of trace levels (low ppb and below)
surface meteorology	wind speed and direction, temperature, barometric pressure, and relative humidity

NCore Monitoring in Minnesota

In 2007, EPA provided funding to the Minnesota Pollution Control Agency (MPCA) to begin the process of establishing an NCore site in the Twin Cities metropolitan area. After evaluating the existing monitoring network, historical data, population trends and meteorology, the MPCA identified the existing monitoring site at the Anoka County Airport in Blaine (MPCA 6010) as a candidate NCore site. Due to space constraints at the original monitoring location, in July 2008, the MPCA relocated the monitoring site approximately one mile west on the Anoka County Airport property. The Anoka County Airport monitoring site is approximately 11 miles north of downtown Minneapolis and approximately 15 miles northwest of downtown St. Paul. Figure B-1 depicts the spatial relationship between the Anoka County Airport and downtown Minneapolis and St. Paul.

Figure B-1: Anoka County Airport NCore site in relationship to Minneapolis-St. Paul



Monitoring Objective

Monitoring activities at the Anoka County Airport NCore site aim to:

- determine compliance with NAAQS,
- observe pollution trends for state and national trends analysis,
- provide pollution data for scientific studies, and
- generate continuous data for daily Air Quality Index reporting and forecasting.

Figure B-2: Anoka County Airport NCore site

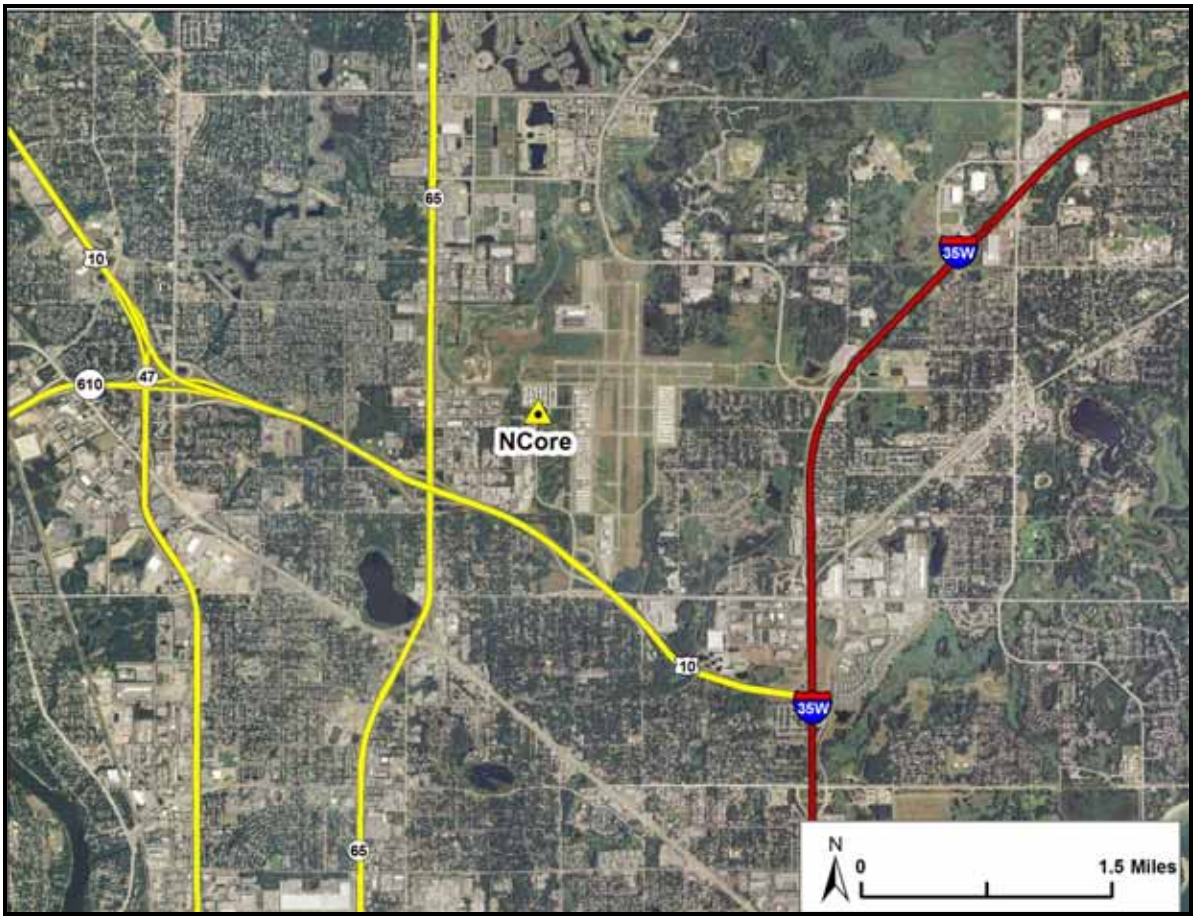


Table B-2: Anoka County Airport NCore monitors

Parameter	Designation	Methods and Analysis	Sampling Frequency	Date Deployed
CO trace level	NCore	IR Photometer GFC– Ecotech model EC9830T	Continuous	8/1/2008
$PM_{2.5}$ FRM	NCore	Gravimetric – Thermo Partisol-Plus Model 2025	1/3	1/1/2010
$PM_{2.5}$ Continuous	NCore/AQI	Beta Attenuation – MetOne BAM sampler	Continuous	8/1/2008
NOx	NCore	Chemiluminescence – API 200A	Continuous	8/1/2008
NO/NOy trace level	NCore	Chemiluminescence – Ecotech model EC9841T	Continuous	8/1/2008
O_3	NCore/AQI	UV Absorption– API 400E	Continuous	8/1/2008
SO_2 trace level	NCore	UV Fluorescence – Ecotech model EC9850T	Continuous	8/1/2008
Meteorological	NCore	Mechanical wind speed and direction, humidity, barometric pressure, temperature, and rainfall.	Continuous	8/1/2008
Non-NCore Parameters				
VOCs	Air Toxics	Gas Chromatography and Mass Spectrometry – SUMMA canisters	1/6	1/1/2011
Carbonyls	Air Toxics	Liquid Chromatography – filter based SEP-Paks	1/6	1/1/2011
Metals	Air Toxics	Inductively Coupled Argon Plasma (ICAP) from TSP filters	1/6	1/1/2011
PFC Air	Special Purpose		1/12	5/1/2009
Mercury Deposition	Mercury Deposition	Free fall collection; ICAP analysis	Weekly Collection	2/1/2008

Quality Assurance Status

The MPCA Quality Assurance procedures for air monitoring are fully compliant with the requirements set forth in 40 CFR Pt. 58, Appendix A. The MPCA will incorporate any additional procedures or requirements for the trace level instruments that are recommended or mandated by US EPA Office of Air Quality Planning and Standards (OAQPS). A Quality Assurance Project Plan (QAPP) will be developed and implemented by the MPCA as quality objectives are finalized.

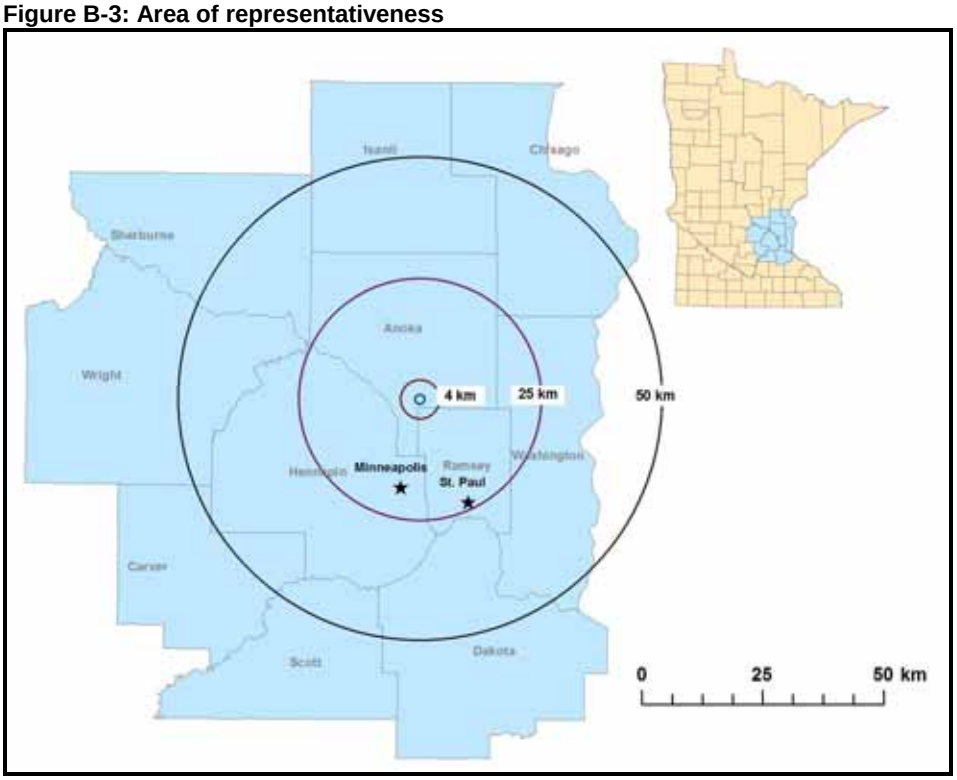
Area of Representativeness

40 CFR Pt. 58, Appendix D provides design criteria for ambient air monitoring. The monitoring objective for the NCore Network is to produce data that represents a broad urban (4 to 50 km) or regional/rural (>50 km) spatial scale. The spatial scale defines the physical dimensions of the air parcel nearest to a monitoring site throughout which actual pollutant concentrations are reasonably similar. The spatial scale is determined by the characteristics of the area surrounding the air monitoring site and the site's distance from nearby air pollution sources such as roadways, factories, etc. In the case of urban NCore sites, the spatial scales to be used are neighborhood and urban. Table B-3 describes the area of representativeness for each pollutant for the Anoka County Airport NCore site. Figure B-3 depicts the range of spatial coverage within the neighborhood and urban scales.

Table B-3: Spatial scale for NCore parameters

Pollutant	Spatial Scale
Ozone	Neighborhood
Nitrogen Oxide	Neighborhood
Carbon Monoxide	Neighborhood
Sulfur Dioxide	Neighborhood
Particles (PM_{10}/$PM_{2.5}$/TSP)	Urban

Figure B-3: Area of representativeness



The majority of monitored pollutants at the Anoka County Airport NCore site are measured at neighborhood scale. As shown in Figure B-4, land use within this scale (4 km radius from the site) is primarily residential (yellow), with a mix of commercial (pink), industrial (purple), recreational (green), and major roadways (black). This land use mix closely aligns to the land use mix for the entire seven-county Twin Cities metropolitan area. Land use summary statistics for the neighborhood (4 km) and urban scales (23 km) are provided in Table B-4.

Figure B-4: Seven-county metropolitan area and Anoka County Airport neighborhood scale land use, 2005

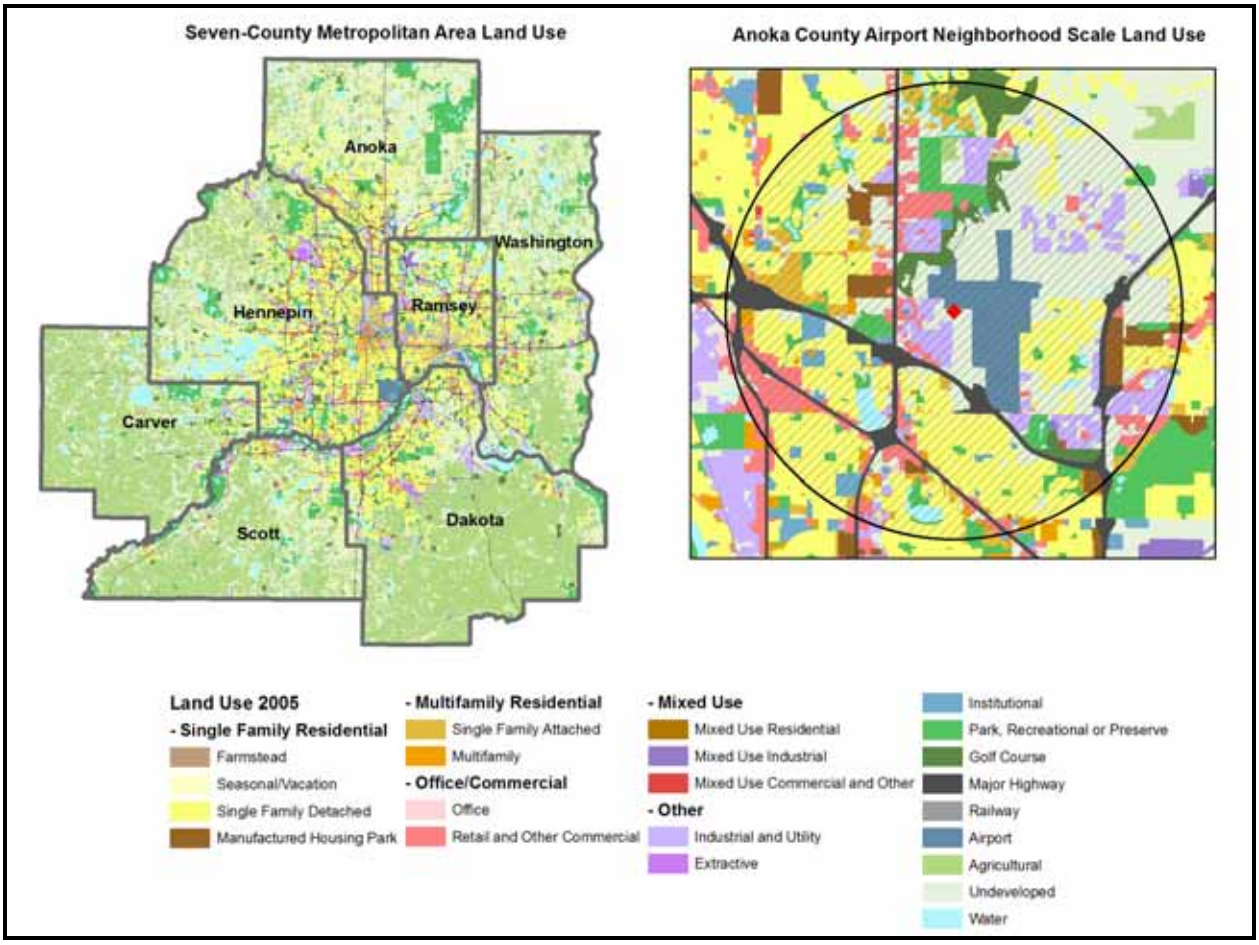


Table B-4: Land use summary statistics for the neighborhood and urban scales, 2005

Neighborhood Scale (4 km Radius)		Urban Scale (23 km Radius)	
Land Use Type	**Percent**	**Land Use Type**	**Percent**
Agriculture	<1	Agriculture	8
Commercial	10	Commercial	7
Industrial	8	Industrial	5
Parks and Recreation	9	Parks and Recreation	13
Residential	38	Residential	34
Transportation[1]	7	Transportation[1]	3
Undeveloped	25	Undeveloped	23
Water	2	Water	7

[1] Airports have been excluded from this land use category in both the neighborhood and urban scale analysis.

The Twin Cities metropolitan area, the core of which lies directly south of the Anoka County Airport NCore site, is the most densely populated area of the state. Figure B-5 describes the population density (persons per square mile) by census block based on 2000 census data. Based on projections by the Minnesota State Demographic Center, with the exception of Ramsey County, the population of the Twin Cities metropolitan area and surrounding counties is expected to grow over the next three decades. Figure B-6 describes the projected population change by county from 2005 to 2035. While not included in Figure B-6, it should also be noted that population increases are expected in adjacent Wisconsin counties. Most notably, the population of St. Croix County is expected to rise by 85,000 residents in 2035, a 134-percent increase from 2000.

Figure B-5: Population density (persons/sq. mile) by census block, 2000

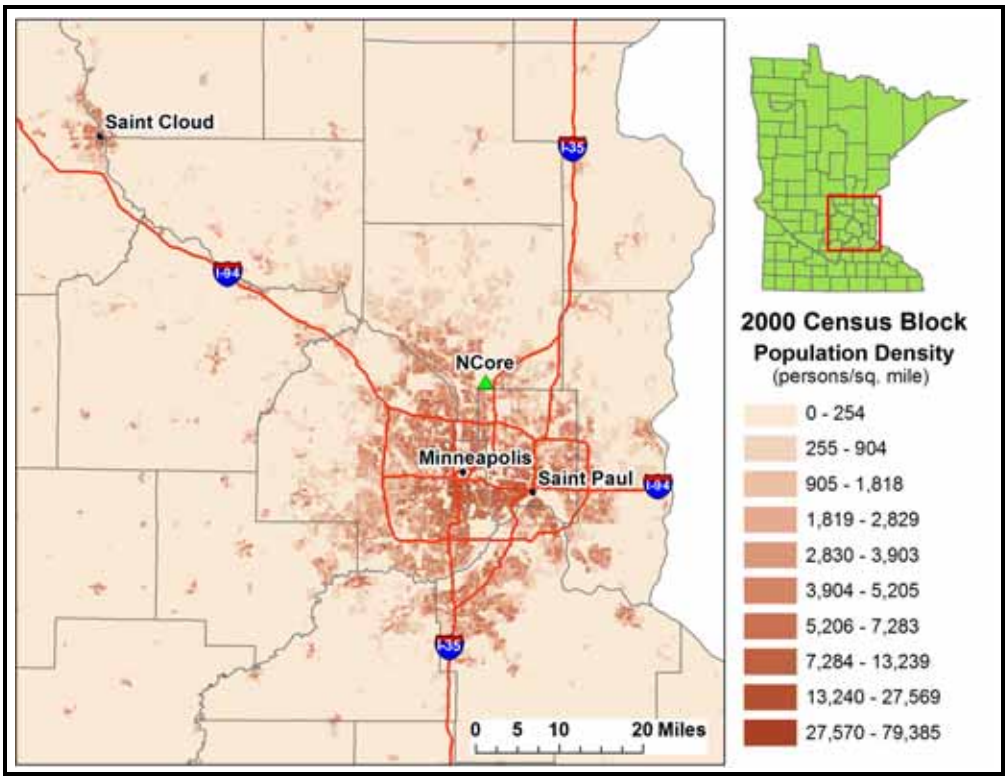
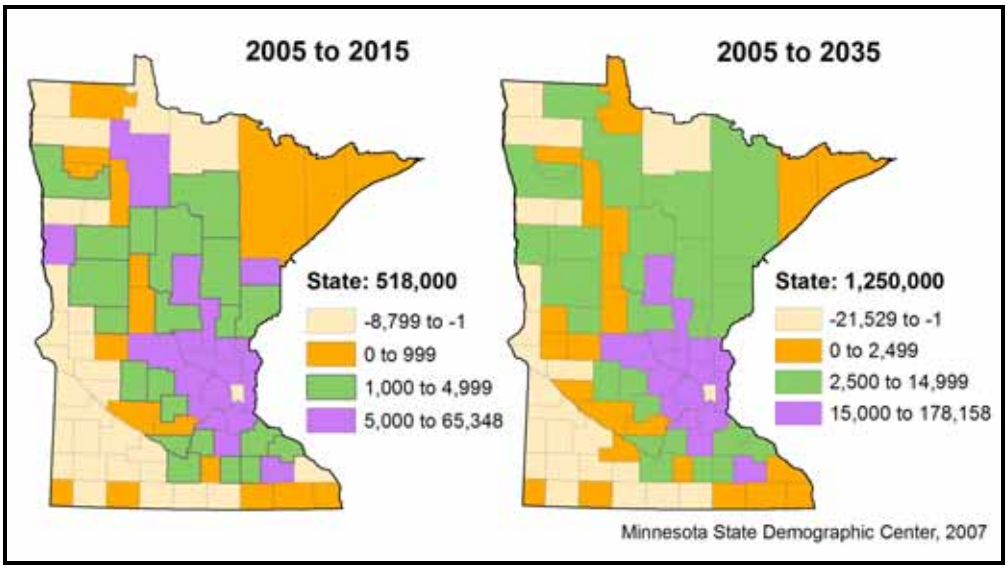


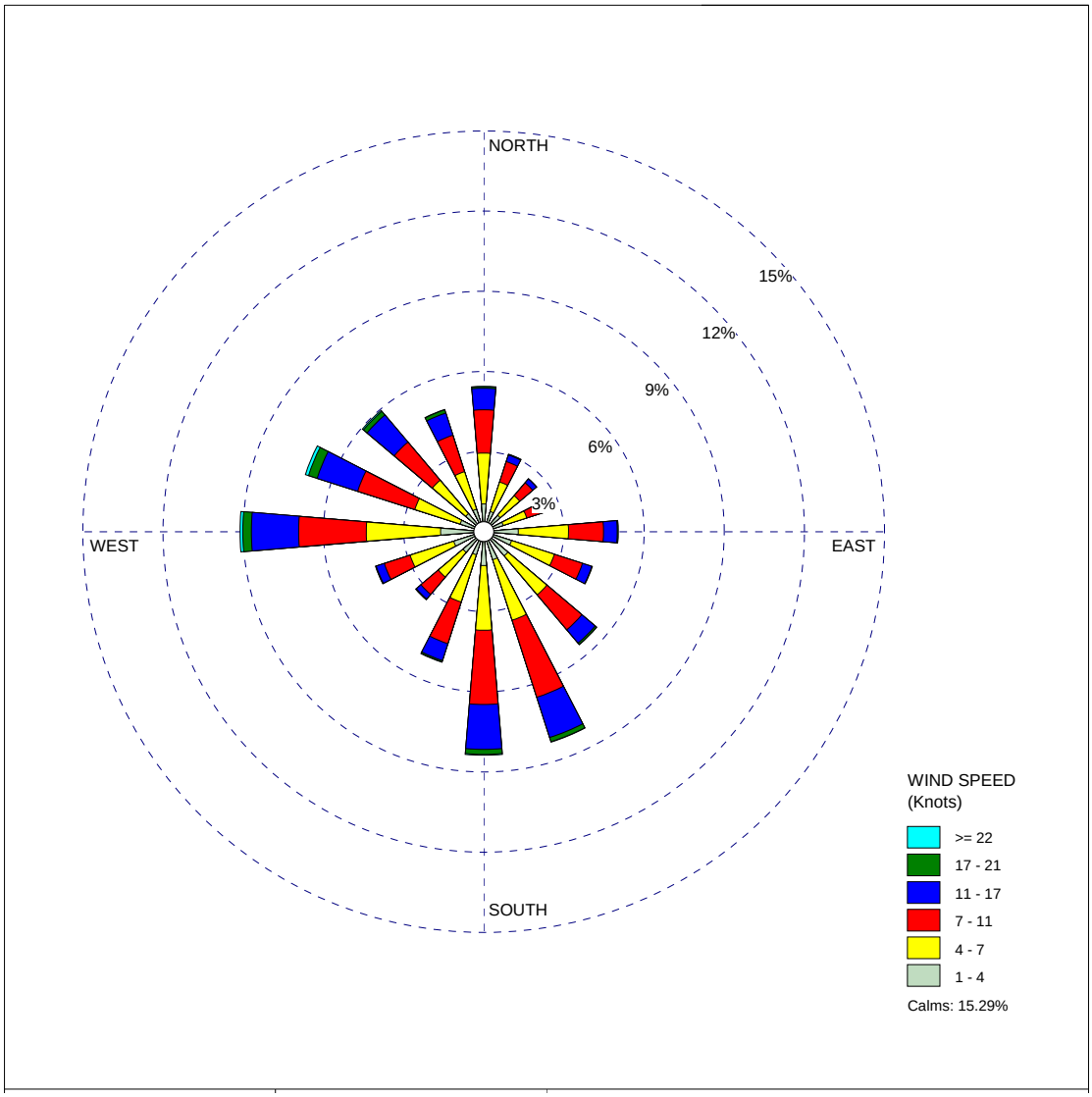
Figure B-6: Projected population change by county, 2005-2035



Wind Direction

The Anoka County Airport NCore site is located north of the urban core and the heavier industrialized areas of the Twin Cities metropolitan area (see Figure B-1). Figure B-7 describes the hourly average wind direction and speed as measured at the Anoka County Airport from 2000-2008. Winds are predominately southerly to southeasterly and westerly to northwesterly. The placement of the NCore site north of the urban core provides the best location for measuring transport and secondary pollutant formation.

Figure B-7: Hourly average wind direction and speed at the Anoka County Airport, 2000-2008



Site Description and Spacing

AQS Site ID: 27-003-1002
MPCA Site ID: 6010
NADP Site ID: MN98
Address: 2700 Airport Rd NE
City: Blaine
County: Anoka

CBSA: Minneapolis-St. Paul, MN-WI
Location Setting: Suburban
Latitude: 45.140601
Longitude: -93.221944
Elevation: 280 m
Year Established: 1979 (Moved in 2008)

NCore Siting Criteria

40 CFR pt. 58, Appendix E – "Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring," contains specific location criteria applicable to NCore and SLAMS siting. The following measurements and data were obtained for evaluation of compliance with the criteria.

Horizontal and Vertical Placement of Sampling Probes

Sampling probes or at least 80 percent of the monitoring path must be located between 2 and 15 meters above ground level for all ozone, sulfur dioxide, and nitrogen dioxide monitoring sites, and for all neighborhood scale lead, particulate and carbon monoxide sites. The gaseous instruments at the Anoka County Airport NCore site are housed in a 14' x 10' x 8' air monitoring shelter, with sample probe inlets located approximately six meters above the ground on the northwest corner of the shelter.

Particulate samplers will be placed both on the roof of the air monitoring shelter (continuous samplers) and on concrete pads adjacent to the shelter (manual samplers). Sample inlets for the continuous monitors are located approximately 2-3 meters above the roofline, and approximately 6-7 meters above ground level. Manual sampler inlets will be located approximately 2-3 meters above the ground.

Spacing from Obstructions

Buildings and other obstacles may possibly scavenge ozone, sulfur dioxide, or nitrogen dioxide and can act to restrict airflow for any pollutant. To avoid this interference, the probe, inlet, or at least 90 percent of the monitoring path must have unrestricted airflow and be located away from obstacles. The distance from the obstacle must be at least twice the height that the obstacle protrudes above the probe, inlet, or monitoring path. The MPCA does not anticipate sampling interference from nearby obstructions at the Anoka County Airport NCore site. Table B-5 summarizes the results of this analysis.

Table B-5: Spacing from obstructions analysis

Obstruction	Height Above Probe	Distance
	(meters)	
Mixed tree stand (west)	7	23
Aspen stand (east)	7	50
T-Hangers (north)	10	40

Spacing from Roadways

Tables E-1, E-2, and Figure E-1 of 40 CFR pt. 58, Appendix E list the minimum distance a monitoring probe must be from roadways based on the Average Daily Traffic (ADT) count. Table B-6 summarizes traffic counts from roadways near the Anoka County NCore site and the minimum separation distance required for each pollutant. Average daily traffic counts were obtained from the Minnesota Department of Transportation.

Table B-6: Spacing from roadways analysis

Roadway	ADT	Approximate Distance (meters)	Minimum Distance Required (meters)			
			Ozone Table E-1	NO/NO_y Table E-1	CO Table E-2	PM Figure E-1
93rd Lane Extension	5,400	140	20	10	10	75
Airport Rd N (access road)	<100	25	-	-	-	-
County Rd 65	55,000	1040	80	75	140	130
Goodhue St	<1000	360	10	10	10	70
State Hwy 10	86,000	1030	160	160	150	160
Southeast Airport Entrance	<500	93	10	10	10	70

Spacing from Minor Sources

The Anoka County Airport NCore pollutant monitors aim to represent a broad neighborhood or urban scale. Nearby sources of pollutants, such as sulfur dioxide, lead or particles can cause high concentration readings at the monitor that are not representative of these broader scales. Therefore, neighborhood and urban scale monitors must be sited such that the influence of nearby pollution sources is minimized. Based on the 2002 National Emissions Inventory (NEI) emissions estimates for sources near the Anoka County Airport NCore site, the MPCA does not anticipate monitoring interference from nearby sources. Table B-7 summarizes the results of this analysis.

Table B-7: Spacing from minor sources analysis

Facility Name	Description	Site Distance (meters)	2002 NEI Emissions Estimates (tpy)					
			CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	VOCs
Anoka County Regional Airport	Reliever airport serving corporate jets and small private aircraft. Less than 70,000 take-offs and landings annually.	900 from main runway	438	2	9	5	<1	14
Arrow Cryogenics Inc.	Metal coating and allied services.	400	<1	<1	7	4	-	6
Safety-Kleen Corp.	Waste management and environmental services.	300	-	-	-	-	-	<1

Figure B-8: Pictures of land use directly adjacent to Anoka County Airport NCore site

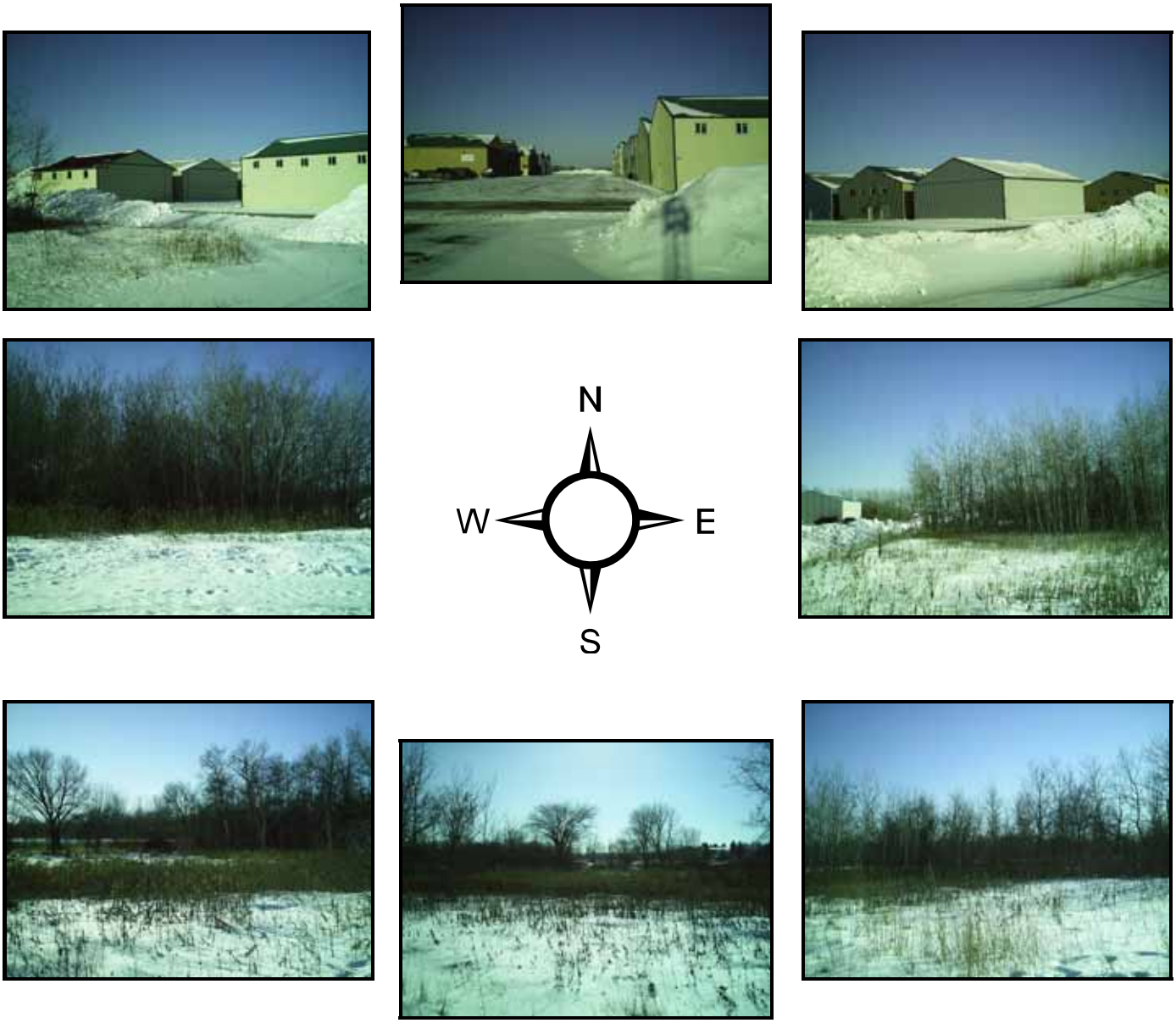


Table B-8: Description of land use directly adjacent to Anoka County Airport NCore site

Direction	Description	Approximate Distance from Probe
North West	Airport T-Hangers	60 meters
North	Airport T-Hangers	40 meters
North East	Airport T-Hangers	75 meters
East	Aspen stand	55 meters
South East	Aspen stand	60 meters
South	Tall grass field	35 meters
South West	Mixed tree species (aspen, box elder, buckthorn)	25 meters
West	Mixed tree species (aspen, box elder, buckthorn)	23 meters

Aerial Image Source: Microsoft Virtual Earth

Site Details

The Anoka County Airport NCore site is located on a half-acre clearing, 900 meters west of the primary runway at the Anoka County Airport in Blaine. The site includes a 14’ x 10’ x 8’ Ekto climate controlled monitoring shelter with space for ten monitors inside and an external stairway leading to the roof for additional monitoring space. The shelter has been wired with 200-amp service and has dedicated phone and data lines. The site is currently using cellular modems for data transfer. The shelter is also equipped with a Bard 24,000 BTU cooling/5 KW heating unit with a programmable digital thermostat, and has 4" of insulation rated at R19.

Outside the monitoring shelter there are three 5' x 25' concrete pads equipped with ten 20-amp GFCI protected outlets. A ten meter tower houses the meteorological gear and the NOy converter. The site has been over designed to accommodate special studies and possible expansions to the NCore parameter network. The perimeter of the Anoka County Airport is fully fenced and entrances are gated, however during business hours gate access is unrestricted. To prohibit public access to monitoring equipment the MPCA has installed an eight foot high security fence.