AECOM

Environment

Submitted to:
ConocoPhillips Alaska Inc.
Anchorage, Alaska

Submitted by:
AECOM
Fort Collins, CO
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Nuiqsut Ambient Air Quality Monitoring Program 2006 Monitoring Year Data Summary April 1, 2006 through March 31, 2007

Final

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Executive Summary

This report summarizes data collected at the Nuiqsut Ambient Air Quality Monitoring Station (Nuiqsut Station) during the 2006 monitoring year (April 2006 through March 2007). The Nuiqsut Station was established in April 1999 to address air quality concerns raised by citizens of Nuiqsut and the North Slope Borough and has fulfilled the Alaska Department of Environmental Conservation (ADEC) 1-year monitoring requirement in the ConocoPhillips Alaska, Inc. Alpine construction permit. This station is part of the Nuiqsut Ambient Air Quality Monitoring Program (Monitoring Program), which is primarily designed to characterize ambient air in Nuiqsut as regional oilfield development continues. Currently, the Monitoring Program is being conducted on a voluntary basis to document air quality in Nuiqsut. Monitoring Program data also is used to support various ambient air quality impact analyses conducted for oilfield development in the Colville Delta region.

The Nuiqsut Station is equipped to continuously measure ambient air quality (oxides of nitrogen [NO_X], sulfur dioxide [SO_2], particulate matter with an aerodynamic diameter of 10 micrometers or less [PM_{10}], and ozone [O_3]) and dispersion meteorology parameters. Air quality and meteorology data collected at the Nuiqsut Station meet strict Quality Assurance (QA) and data capture requirements of the United States Environmental Protection Agency (USEPA) Prevention of Significant Deterioration program as administered by ADEC and other specific ADEC ambient monitoring QA requirements. Protocols used to collect data at the Nuiqsut Station are fully described in the project Monitoring and Quality Assurance Project Plan (QAPP).

There were no procedures used during the monitoring year that differed from those specified in the QAPP. In general, QAPP QA goals were met for all parameters

As shown in **Table ES-1**, air quality and meteorological quarterly data capture exceeded QAPP goals for a majority of the parameters with the exceptions shown in bold. The primary problems affecting data capture included several mechanical failings of wind sensors, low flow errors with the PM_{10} measurement upon power failure recoveries, and an O_3 instrument failure that was not field serviceable.

The data record along with the prior years of data collection gives a history that characterizes typical air quality conditions experienced in Nuiqsut and the likelihood of any air quality exceedances. **Tables ES-2** through **ES-5** summarize average nitrogen dioxide (NO_2), SO_2, PM_{10}, and O_3 concentrations measured during the monitoring year. Measured concentrations of NO_2, SO_2, and O_3 were well below Alaska Ambient Air Quality Standards (AAAQS), which are the same as the national standards for the pollutants measured.

The typical hourly NO_2 concentrations were just above instrument detection, and the annual average was well below applicable AAAQS. Concentrations measured this monitoring year were generally lower than historical measurements.

Measured SO_2 concentrations were at or below instrument detection the entire year. The low concentrations measured are consistent with an airshed containing relatively few and widely dispersed SO_2 sources. This trend has been typical of SO_2 measurements since monitoring began.

The annual average of hourly PM_{10} concentrations was well below the applicable AAAQS and reflective of global background levels.

O_3 concentrations measured during this monitoring year were typical of seasonal averages measured on the Alaskan North Slope (Prudhoe Bay, Kuparuk River Unit, and Barrow). In the absence of large combustion sources, frontal boundaries and high incoming solar radiation, ambient O_3 levels will be spatially homogeneous and representative of a regional background.

Table ES-1 Recovery Statistics 2006, Annual Data Summary

Parameter	2nd Quarter 2006 (%)	3rd Quarter 2006 (%)	4th Quarter 2006 (%)	1st Quarter 2007 (%)	Required Capture Rates (%)
Meteorological					
10-m Horizontal Wind Speed	99.3	99.5	97.1	99.3	90
10-m Horizontal Sigma-u (σ_u)	99.3	99.5	97.1	99.3	
10-m Horizontal Wind Direction	99.3	**79.5**	**0.0**	**28.1**	
10-m Sigma-Theta (σ_θ)	99.3	**79.5**	**0.0**	**28.1**	
10-m Vertical Wind Speed	99.1	98.8	97.0	**49.5**	
10-m Vertical Sigma-w (σ_w)	99.1	98.8	97.0	**49.5**	
10-m Temperature	99.4	99.5	99.7	99.6	
2-m Temperature	99.4	99.5	99.7	99.6	
10-2m Temperature Lapse	99.4	99.5	99.7	99.6	
Total Solar Radiation	99.2	99.5	100	99.6	
Air Quality					
NO_2	98.4	98.4	97.1	97.9	80
SO_2	98.3	97.9	94.4	97.9	
O_3	94.6	97.0	97.1	**70.2**	
Particulate (PM_{10}) (TEOM)	83.3	99.5	83.4	91.9	

Table ES-2 Measured Nitrogen Dioxide, 2006 Annual Data Summary

Monitoring Period	Year	Period Mean (ppm)[1]	Number of Exceedances
2nd Qtr.	2006	0.001	None
3rd Qtr.	2006	0.001	None
4th Qtr.	2006	0.001	None
1st Qtr.	2007	0.003	None
Annual	2006	0.001	None

[1] Annual average.
NAAQS/AAAQS:
Annual - 0.053 ppm (100 µg/m^3) – Compared to the annual arithmetic mean.

Table ES-3 Measured Sulfur Dioxide, 2006 Annual Data Summary

Monitoring Period	Year	3-hour (ppm)[1]		24-hour (ppm)[2]		Period Mean (ppm)[3]	Number of Exceedances
		1st high	2nd high	1st high	2nd high		
2nd Qtr.	2006	0.002	0.002	0.002	0.001	0.001	None
3rd Qtr.	2006	0.001	0.001	0.000	0.000	0.000	None
4th Qtr.	2006	0.002	0.001	0.001	0.001	0.000	None
1st Qtr.	2007	0.002	0.002	0.002	0.001	0.000	None
Annual	2006	0.002	0.002	0.002	0.002	0.000	None

[1] Rolling 3-hour average.
[2] Midnight-to-midnight 24-hour average.
[3] Annual average.
NAAQS/AAAQS:
3-hour - 0.5 ppm (1,300 µg/m^3) – Non-overlapping block averages starting at midnight not to be exceeded more than once per year.
24-hour - 0.14 ppm – Midnight to midnight average not to be exceeded more than once per year.
Annual - 0.03 ppm – Compared to the annual arithmetic mean.

Table ES-4 Measured PM_{10} Data, 2006 Annual Data Summary

Monitoring Period	Year	24-hour (µg/m^3)[1]		Period Mean (µg/m^3)[2]	Number of Exceedances
		1st high	2nd high		
2nd Qtr.	2006	25.3	25.1	8.4	None
3rd Qtr.	2006	132.9	76.7	12.1	None
4th Qtr.	2006	84.8	76.9	8.4	None
1st Qtr.	2007	29.9	17.2	5.8	None
Annual	2006	132.9	84.8	8.8	None

[1] Midnight-to-midnight 24-hour average.
[2] Annual average.
NAAQS/AAAQS:
24-hour – 150 µg/m^3 – Not to be exceeded more than once per year measured from midnight to midnight at USEPA Standard Conditions.
Annual – 50 µg/m^3 – Compared to the 3-year average of the weighted annual arithmetic mean concentration measured at USEPA Standard Conditions.

Table ES-5 Measured Ozone Data, 2006 Annual Data Summary

Monitoring Period	Year	8-hour (ppm)[1]			Period Mean (ppm)[2]	Number of Exceedances
		1st high	2nd high	4th high		
2nd Qtr.	2006	0.047	0.047	0.046	0.020	None
3rd Qtr.	2006	0.026	0.026	0.026	0.016	None
4th Qtr.	2006	0.032	0.032	0.032	0.024	None
1st Qtr.	2007	0.033	0.033	0.033	0.023	None
Annual	2006	0.047	0.047	0.046	0.021	None

[1] Rolling 8-hour average.
[2] Annual average.
<u>NAAQS/AAAQS:</u>
8-hour - 0.08 ppm – Compared to the 3-year average of the fourth-highest daily maximum rolling 8-hour average concentrations.

1.0 Introduction

1.1 Project Summary

Since April 9, 1999 (prior to Alpine Central Processing Facility startup), ConocoPhillips Alaska, Inc. (CPAI) has operated an air quality and dispersion meteorology monitoring station in Nuiqsut, Alaska (Nuiqsut Station), which is located on the Alaskan North Slope. This station is part of the Nuiqsut Ambient Air Quality Monitoring Program (Monitoring Program), which primarily is designed to characterize ambient air in Nuiqsut as regional oilfield development continues. This Monitoring Program has been administered according to United States Environmental Protection Agency (USEPA) Prevention of Significant Deterioration (PSD) protocols; therefore, data collected is considered PSD quality.

Currently, the Monitoring Program is being conducted on a voluntary basis to document air quality in Nuiqsut. Monitoring Program data also is used to support various ambient air quality impact analyses conducted for oilfield development in the Colville Delta region.

Since the beginning, the Monitoring Program has been modified to enhance Quality Assurance (QA) and Quality Control (QC) and increase program utility through the addition of monitored parameters. Major Monitoring Program modifications include:

- Collocated Federal Reference Method (FRM) particulate matter with an aerodynamic diameter of 10 micrometers or less (PM_{10}) sampling initiated to evaluate the Monitoring Program Federal Equivalent Method sampling methodology (July 14, 2000). Collocated FRM PM_{10} sampling was discontinued in fall 2002.
- Enhanced dispersion meteorology characterization through the addition of 10-meter (m) temperature, vertical wind speed, and solar radiation monitoring (July 24, 2001).
- Expanded background air quality evaluation through the addition of ozone (O_3) monitoring (November 19, 2004).

Since inception, the specific technical objectives of the Monitoring Program are to:

- Collect data meeting QA and data capture requirements of the USEPA PSD Program and other specific Alaska Department of Environmental Conservation (ADEC) ambient monitoring QA requirements (ADEC 1996);
- Document preconstruction air quality impacts at Nuiqsut prior to operation of Alpine (fulfilled);
- Document air quality conditions after Alpine is operational;
- Meet air quality and meteorological monitoring requirements listed in Alpine Permit No. 0073-AC060 (fulfilled); and
- Document dispersion meteorology conditions in Nuiqsut to support refined modeling of potential impacts in the region.

1.2 Measurement Methods

To meet project technical objectives, the Nuiqsut Station is instrumented and equipped to continuously measure the parameters listed in **Table 1-1**. **Table 1-1** also details the methods and instruments used for measurement. A complete description of the Monitoring Program, including the QA plan, is contained in the ADEC approved Monitoring and Quality Assurance Project Plan (QAPP), which consists of:

- The original project monitoring plan (SECOR 2000), approved by ADEC in April 2000;

- The Partisol Addendum to the original monitoring plan (SECOR 2001), approved by ADEC in October 2001;
- The draft Expanded Meteorology Addendum to the original monitoring plan (SECOR 2002), final ADEC approval pending; and
- The draft Ozone Monitoring Addendum to the original monitoring plan (SECOR 2004), final ADEC approval pending.

1.3 Variations from Quality Assurance Project Plan

The O_3 instrument could not be calibrated because the measurement system primary standard was offline during the fourth quarter 2006 and first quarter 2007 calibrations. The calibration check on the PM_{10} instrument was not properly documented and the calibration was not valid during the first quarter 2007 calibration. As discussed in Section 2.4.1, several of the precision check goals were not achieved for select parameters in select quarters. Otherwise, there were no procedures used during the monitoring year that differed from those specified in the QAPP.

Table 1-1 Measurement Methods, 2007 Annual Data Summary

Parameter	Manufacturer/Model	Sample Frequency	Averaging Period	Measurement Range	Lower Detection Limit	Method
Nitrogen Oxides (NO_X, nitrogen dioxide [NO_2], nitric oxide [NO])	Thermo Environmental Instruments (TECO) Model 42C	Continuous	1-hour	1-500 parts per billion (ppb)	0.5 ppb	Chemiluminescence (USEPA reference method RFNA-1289-074)
Sulfur Dioxide (SO_2)	Thermo Environmental Instruments (TECO) Model 43C	Continuous	1-hour	2-500 ppb	2 ppb	Pulsed Fluorescence (USEPA equivalent method EQSA-0486-060)
PM_{10}	Rupprecht & Patashnick (R&P) Model 1400ab TEOM PM_{10}	Continuous	1-hour	<5 micrograms per cubic meter (µg/m^3) to several grams per cubic meter (g/m^3)	<5 µg/m^3	Tapered Element Oscillating Microbalance (USEPA equivalent method EQPM-1090-079)
O_3	Thermo Environmental Model 49	Continuous	1-hour	0-1,000 ppb	2 ppb	Pulsed UV Photometric (USEPA equivalent method EQOA-0880-047)
Horizontal Wind Speed (u) (10-m)	R.M. Young Wind Monitor AQ – 05305	Continuous	1-hour	0 to 50 meters per second (m/s)	0.4 m/s	Propeller/Magnetically Induced AC
Wind Speed Standard Deviation (σ_u) (10-m)	Campbell Scientific 23X	Continuous	1-hour	N.A.	N.A.	Computed by data logger
Wind direction (θ) (scalar) (10-m)	R.M. Young Wind Monitor AQ – 05305	Continuous	1-hour	0 to 360º	0.5 m/s at 10º displacement	Lightweight vane and precision potentiometer
Sigma-Theta (σ_θ) (10-m)	Campbell Scientific Model 23X	Continuous	1-hour	0 to 103.9 degrees	N.A.	Single Pass Estimator of Wind Direction Standard Deviation (Yamartino 1984)
Temperature (2-m)	YSI 44020	Continuous	1-hour	-50 degrees Celsius (°C) to 50°C	N.A.	Motor aspirated/shielded thermistor (triple-element)
Temperature (10-m)	YSI 44020	Continuous	1-hour	-50°C to 50°C	N.A.	Motor aspirated/shielded thermistor (triple-element)
10-m – 2-m Temperature Lapse (ΔT)	Campbell Scientific Model 23X	Continuous	1-hour	-100°C to 100°C	N.A.	Numerical Subtraction
Vertical Wind Speed (w) (10-m)	RM Young Propeller Anemometer Model 27106T	Continuous	1-hour	-35 m/s to 35 m/s	±0.25 m/s	Four blade helicoid propeller/AC
Sigma-w (σ_w) (10-m)	Campbell Scientific Model 23X	Continuous	1-hour	0 to 35 m/s	N.A.	Standard Deviation

N.A. = Not Applicable.

2.0 Station Performance Summary

2.1 Significant Project Events

Table 2 1 summarizes significant project events occurring during the year. Detailed discussions of project events affecting data capture are presented in Section 2.2.

Table 2-1 Significant Project Events, 2006 Annual Data Summary

Date	Event/Comment
April 1 through June 9, 2006	Several hourly O_3 measurements made after the hour containing the nightly Level I calibration were biased because the sample stream was contaminated with residual span gas. A review of strip chart data made it possible to properly identify and invalidate affected hours.
April 18 through May 2, 2006	The PM_{10} analyzer was off-line following a power failure because the instrument could not achieve the designated set point for the sample flow.
May 2 through June 7, 2006	The PM_{10} analyzer was brought online by decreasing the sample flow set point to 1 lpm while maintaining sampling system total flow at 16.67 lpm, which is the flow rate necessary to produce the sample inlet particulate cut point. Since the cut point was maintained and the system was accurately measuring the sample flow, measured concentrations are valid. During the quarterly maintenance visit, the sample flow line obstruction was removed and all flow set points returned to USEPA designated values. No data was invalidated
June 7 through June 8, 2006	The first quarter calibration of the air quality measurement systems was conducted by AECOM. The calibration and routine site maintenance visit confirmed all air quality systems were reporting measurements to within acceptable limits. The independent performance audit of the air quality system and the semiannual audit of the meteorological measurement systems were conducted by AMSTech. The audit confirmed all systems were reporting measurements to within acceptable limits.
June 7 through September 11, 2006	The PM_{10} analyzer ambient temperature sensor wiring was damaged during instrument maintenance on June 7, 2006. The temperature sensor was replaced during the third quarter calibration. Since the instrument temperature sensor was offline, standard flow calculations from hour 1000 on June 7, 2006 through September 11, 2006 were based on a seasonal average temperature of 18°C. After the temperature sensor was replaced standard flow calculations were again based on measured temperature.
August 1 through August 31, 2006	Hourly O_3 measurements following the nightly Level I calibrations were invalidated due to contamination from span gas that was not completely purged from the sampling system.
August 18 through September 11, 2006	The O_3 primary standard data was unavailable due to a ruptured sample pump diaphragm. The sample pump was repaired during the third quarter calibration.
September 11 through September 12, 2006	The third quarter air quality and meteorological measurement systems calibration was conducted by AECOM. The calibration and routine site maintenance visit confirmed all air quality systems were reporting measurements to within acceptable limits.
September 12, 2006	The third quarter air quality and solar radiation measurement systems independent performance audit was conducted by AMSTech. The solar radiation measurement system audit was conducted anticipating it could not be done as scheduled in December 2006 due to lack of solar radiation at that time. The audit confirmed all audited systems were reporting measurements to within acceptable limits.
September 12 through December 12, 2006	A cracked zero air supply charcoal canister was noted and replaced with a used but unbroken canister during the third quarter calibration. The replacement canister contained residual NO_X that contaminated automatic NO_X calibration checks. The contamination signal was quantified and subtracted from the generated precision check and zero concentrations. The contamination was purged from the canister by the end of November; regardless, the canister was replaced during the fourth quarter calibration. The episode resulted in the invalidation of several QC zero/span checks at the start of the period, but no ambient data invalidation resulted.

Table 2-1 Significant Project Events, 2006 Annual Data Summary

Date	Event/Comment
September 12 through December 13, 2006	Wind direction and wind direction standard deviation (σ_θ) data was invalidated. The wind direction measurement accuracy failed the second semiannual audit because a set screw connecting the sensor potentiometer shaft to the sensor vane had worked loose between the third quarter calibration and the audit. Data was invalidated from the last time the sensor was operating in a known condition (third quarter calibration) until it was repaired (fourth quarter audit).
October 31, 2006 through March 31, 2007	The O_3 measurement system primary standard was offline. After several field repairs including rebuilding the pump, it was determined during the fourth quarter 2006 calibration that the primary standard should be shipped off-site for repairs. Therefore, on January 24, 2007, the on-site technician removed the primary standard from service and shipped it to AECOM for repairs. The primary standard was repaired and reinstalled on June 21, 2007, during the second quarter calibration and routine maintenance visit the next quarterly visit. The O_3 instrument passed audit tests and the period was bracketed by valid precision checks resulting in no data invalidation due to the primary standard malfunction.
November 11 through November 16, 2006	A low main flow rate resulted from a flow restriction in the sample tube caused by accumulated snow. The PM_{10} measurement system main flow rate was 12 percent low. Though the main flow rate was slightly low, the total flow rate was still within acceptable limits resulting in total flow rate within specification and a proper size cut. As a result, no data was invalidated.
November 16 through November 29, 2006	PM_{10} data was missing as the PM_{10} instrument did not resume sampling following a power failure. The instrument resumed sampling after the error was cleared by the on-site technician.
November 14 through December 11, 2006	Hourly SO_2 measurements for 2 to 3 hours immediately following nightly Level I calibrations were invalidated due to contamination from span gas that was not completely purged from the sampling system. Span gas was slow to be purged due to low sample flow caused by a degrading SO_2 sample pump that was rebuilt during the fourth quarter calibration.
December 11 through December 14, 2006	The fourth quarter air quality measurement system calibration was conducted by AECOM. The calibration and routine site maintenance visit confirmed all air quality systems that could be calibrated were reporting measurements to within acceptable limits. The O_3 measurement system could not be calibrated because the system primary standard was offline.
December 13 and December 14, 2006	The fourth quarter air quality and second semiannual meteorological measurement systems independent performance audits were conducted by AMSTech. With the exception of wind direction measurement accuracy, the audit confirmed all audited systems were reporting measurements to within acceptable limits. The solar radiation measurement system could not be audited due to insufficient solar radiation; however, this system was audited in September 2006 anticipating this issue.
December 13, 2006	A wind direction measurement system accuracy check was conducted by AECOM. The wind direction measurement accuracy failed the second semiannual audit because the set screw connecting the sensor potentiometer shaft to the sensor vane had loosened. Therefore, the sensor was repaired and the accuracy checked before returning it to service.
December 13 through March 5, 2007	Wind direction and wind direction standard deviation (σ_θ) data was invalidated. The wind direction measurement accuracy failed the second semiannual calibration conducted in March 2007 because the sensor potentiometer keyway disengaged from the sensor vane sometime between the second semiannual audit that occurred in December 2006 and the semiannual calibration. Data was invalidated from the last time the sensor was operating in a known condition (second semiannual audit) until it was repaired (second semiannual calibration).
January 1 through March 5, 2007	The PM_{10} measurement system main flow rate degraded from 22 to 42 percent low over the period. The low main flow rate resulted from a flow restriction in the sample tube caused by accumulated snow. This situation caused excess stress on the instrument sample pump diaphragm that subsequently developed a leak exacerbating the flow rate problem. Though the main flow rate was low, the total flow rate was still within acceptable limits; therefore, the sample inlet was still reliably making the PM_{10} cut point. The low flow situation was corrected during the second quarter calibration and no data invalidation resulted.
January 24 through March 5, 2007	Vertical wind speed and vertical wind speed standard deviation data was invalidated. The vertical wind speed sensor propeller was found missing a blade during the second semiannual calibration. Data was invalidated from the last time the sensor was operating in a known condition (January 24, 2007 station visit by the on-site technician) until it was repaired (second semiannual calibration).

Table 2-1 Significant Project Events, 2006 Annual Data Summary

Date	Event/Comment
March 5 and March 6, 2007	The first quarter air quality and second semiannual meteorological measurement systems calibrations were conducted by AECOM. With the exception of wind direction measurement accuracy, the calibration confirmed all systems that could be calibrated were reporting measurements to within acceptable limits with the exceptions of O_3, PM_{10} and solar radiation. The calibration check on the PM_{10} instrument was not properly documented. The instrument passed the bracketing calibrations and audits in the previous and subsequent quarters and thus no data was invalidated. The O_3 measurement system could not be calibrated because the primary standard was offline, and the solar radiation measurement system could not be calibrated due to insufficient sunlight as a result of storms.
March 5 and March 6, 2007	The first quarter air quality measurement system independent performance audit was conducted by AMSTech. The audit confirmed all systems were reporting measurements to within acceptable limits.
March 6 through March 21, 2007	Several weekly precision checks were not executed properly following the calibration/audit. This was a direct result of contamination present in the system following installation of a new calibration gas cylinder. This situation has typically occurred as the system pressure regulator adjusts to the new input pressure and gas cylinder concentration. After purging a sufficient volume of gas through the system, the contamination was removed and normal precision check execution resumed. This situation did not affect hourly measurements.
March 6 through March 31, 2007	The O_3 data was invalidated. On March 22, 2007, an O_3 instrument failure could not be repaired on-site, and the instrument was removed from the station for repairs. No bracketing calibrations exist to properly assess measurement system accuracy at the time of failure; therefore, data was invalidated back to the last known working state (first quarter audit).
March 7 through March 26, 2007	The PM_{10} data logged independently by the station data logger was used in place of data normally collected from the PM_{10} instrument itself. Since the PM_{10} measurement system is not calibrated using the station data logger, the data logged by the station data logger has a known systematic bias. That bias was removed by establishing a correlation between data logged by the PM_{10} instrument and data logged by the station data logger during January and February 2007.
March 26 through March 31, 2007	The PM_{10} data was invalidated. The PM_{10} measurement system sample pump failed and eliminated all flow through the instrument.

2.2 Missing, Invalid and Adjusted Data

All hourly NO_X, SO_2, and O_3 data is routinely adjusted for instrument drift according to the procedure outlined in the USEPA Quality Assurance Handbook for Air Pollution Measurement Systems Vol. II: Pt. 1 (USEPA 1998) as presented in Appendix A, Section A.3. After instrument drift corrections are applied, all hourly NO_X, SO_2, and O_3 data less than 0.000 ppm have been investigated and then set to 0.000 ppm to conservatively remove any remaining negative bias.

The following subsections provide details pertaining to non-routine data losses for each specific portion of the monitoring network. Additional data losses include those due to power failures, routine network operation and maintenance, calibrations, audits, and precision checks.

2.3 Network Data Completeness

Table 2-2 provides a summary of quarterly data capture for each parameter during the monitoring year. Data capture rates for each continuous air quality and meteorological parameter have been calculated according to the procedure discussed in Appendix A, Section A.1. Quarterly network data capture rates for the year achieved QAPP goals for all parameters except horizontal wind direction, σ_θ, vertical wind speed, σ_w, and O_3 measurements.

Table 2-2 Data Recovery Statistics, 2006 Annual Data Summary

Parameter	2nd Quarter 2006 (%)	3rd Quarter 2006 (%)	4th Quarter 2006 (%)	1st Quarter 2007 (%)	Required Capture Rates (%)
Meteorological					
10-m Horizontal Wind Speed	99.3	99.5	97.1	99.3	90
10-m Horizontal Sigma-u (σ_u)	99.3	99.5	97.1	99.3	
10-m Horizontal Wind Direction	99.3	**79.5**	**0.0**	**28.1**	
10-m Sigma-Theta (σ_θ)	99.3	**79.5**	**0.0**	**28.1**	
10-m Vertical Wind Speed	99.1	98.8	97.0	**49.5**	
10-m Vertical Sigma-w (σ_w)	99.1	98.8	97.0	**49.5**	
10-m Temperature	99.4	99.5	99.7	99.6	
2-m Temperature	99.4	99.5	99.7	99.6	
10-2m Temperature Lapse	99.4	99.5	99.7	99.6	
Total Solar Radiation	99.2	99.5	100	99.6	
Air Quality					
NO_2	98.4	98.4	97.1	97.9	80
SO_2	98.3	97.9	94.4	97.9	
O_3	94.6	97.0	97.1	**70.2**	
Particulate (PM_{10}) (TEOM)	83.3	99.5	83.4	91.9	

All data losses were thoroughly detailed in Section 2.2. In summary the following events resulted in data capture rates below QAPP goals:

- Horizontal wind direction and σ_θ data losses were primarily the result of a loose set screw and later disengagement of the keyway connecting the sensor potentiometer shaft to the sensor vane;
- Vertical wind speed and σ_w data losses were the result of the vertical wind speed sensor damage resulting in the loss of a blade; and
- O_3 data losses were the result of an instrument failure that was unable to be repaired on site.

2.4 Precision Statistics

2.4.1 Monitoring Network Precision Statistics

Quarterly NO_2, NO, SO_2, and O_3 precision check statistics shown in **Tables 2-3** through **2-6** indicate all air quality systems were reporting measurements to within QAPP established tolerances. Precision statistics have been calculated for NO_2, NO, SO_2, and O_3 instruments based on USEPA methods, which are summarized in Appendix A, Section A.2. Individual results from each precision check conducted are listed in Appendix B, **Tables B-1** through **B-4**. The remarks sections in **Tables 2-3** through **2-6** detail when scheduled precision checks were missed or invalid and if this resulted in precision checks being performed less frequently than required. Precision checks are scheduled to occur more frequently than required to account for this possibility.

Table 2-3 Second Quarter 2006 Precision Statistics Summary

Parameter	Number of Precision Checks (N)	Average Percent Difference ($đ_j$)	Standard Deviation (S_j)	Upper 95% Probability Limit (U_{95})	Lower 95% Probability Limit (L_{95})
NO	12	-0.1	4.3	8.3	-8.4
NO_2	12	-0.2	1.0	1.7	-2.1
SO_2	12	-1.2	7.0	13.0	-15.0
O_3	12	1.6	4.2	10.0	-6.7
Precision Goal	N/A	±15	N/A	15	-15

Remarks:

Six valid precision checks are required per quarter by the QAPP, 13 were performed and the valid number is indicated in the table.

Table 2-4 Third Quarter 2006 Precision Statistics Summary

Parameter	Number of Precision Checks (N)	Average Percent Difference ($đ_j$)	Standard Deviation (S_j)	Upper 95% Probability Limit (U_{95})	Lower 95% Probability Limit (L_{95})
NO	11	6.5	1.7	9.9	3.1
NO_2	10	-0.5	2.4	4.1	-5.2
SO_2	10	5.5	5.3	16.0	-5.0
O_3	9	-0.2	7.8	15.0	-15.4
Precision Goal	N/A	±15	N/A	15	-15

Remarks:

Six valid precision checks are required per quarter by the QAPP, 12 were performed and the valid number is indicated in the table.

SO_2 Precision Statistics: Variation in the absolute average percent difference of individual results and a slight positive measurement bias lead to a high standard deviation and upper probability limit. The variation was a result of changes in calibration system sample residence time from one precision check to the next. The sample residence time variation resulted from an underperforming instrument sample pump. The pump was rebuilt before it failed as part of the third quarter calibration conducted in September.

O_3 Precision Statistics: Three sequential O_3 precision checks in late August and early September were not conducted because the O_3 primary standard was inoperable. While Monitoring Program QA goals were not met, no data was invalidated since O_3 precision checks conducted before and after the system malfunction showed the instrument operating within acceptable limits.

Table 2-5 Fourth Quarter 2006 Precision Statistics Summary

Parameter	Number of Precision Checks (N)	Average Percent Difference ($đ_j$)	Standard Deviation (S_j)	Upper 95% Probability Limit (U_{95})	Lower 95% Probability Limit (L_{95})
NO	12	0.6	2.5	5.5	-4.4
NO_2	11	6.0	4.2	14.2	-2.2
SO_2	8	0.2	1.9	4.0	-3.6
O_3	4	-0.9	3.0	4.9	-6.8
Precision Goal	N/A	±15	N/A	15	-15

Remarks:

Six valid precision checks are required per quarter by the QAPP, 13 were performed and the valid number is indicated in the table.

SO_2 Precision Statistics: Five consecutive weekly SO_2 precision checks were not executed properly during the quarter due to low measurement system sample flow. While Monitoring Program QA goals were not achieved, no data was invalidated because the period was bracketed by nightly Level I calibrations, weekly precision checks and a quarterly calibration that demonstrated the system was reporting measurements to within acceptable limits.

O_3 Precision Statistics: No valid O_3 precision checks were conducted after October 24 because the measurement system primary standard was offline. While Monitoring Program QA goals were not achieved, no data was invalidated because the period was bracketed by weekly precision checks and a quarterly independent QA performance audit that demonstrated the instrument was reporting measurements to within acceptable limits.

Table 2-6 First Quarter 2007 Precision Statistics Summary

Parameter	Number of Precision Checks (N)	Average Percent Difference ($\bar{d}_j$)	Standard Deviation (S_j)	Upper 95% Probability Limit (U_{95})	Lower 95% Probability Limit (L_{95})
NO	11	-0.6	2.9	5.1	-6.2
NO_2	11	0.5	1.4	3.2	-2.2
SO_2	11	-1.4	1.7	1.9	-4.6
O_3	0	NA	NA	NA	NA
Precision Goal	N/A	±15	N/A	15	-15

Remarks:

Six valid precision checks are required per quarter by the QAPP, 15 were performed and the valid number is indicated in the table.

NO, NO_2, and SO_2 Precision Statistics: Four consecutive weekly precision checks were not executed properly during the quarter following the calibration/audit. This was a direct result of contamination present in the system following installation of a new calibration gas cylinder. This situation typically has occurred as the system pressure regulator adjusts to the new input pressure and concentration. After purging a sufficient volume of gas through the system, the contamination is removed and normal precision check execution resumes. While Monitoring Program QA goals were not achieved, no data was invalidated because the period was bracketed by nightly Level I calibrations and weekly precision checks, and a quarterly calibration and audit that demonstrated the system was reporting measurements to within acceptable limits.

O_3 Precision Statistics: No valid O_3 precision checks were conducted because the measurement system primary standard was offline. While Monitoring Program QA goals were not achieved, no data was invalidated because the period was bracketed by quarterly independent QA performance audits that demonstrated the instrument was reporting measurements to within acceptable limits. The measurement system primary standard was replaced during the second quarter 2007 calibration and routine maintenance visit.

2.5 Accuracy Statistics

Meteorological and ambient air quality measurement systems are subjected to periodic calibrations/QC checks and independent QA performance audits to document measurement system accuracy. All calibration/QC check and audit equipment rely on NIST or other traceable standards. The purpose of calibration/QC and audit checks is to challenge measurement systems with known inputs, verifying the response of each system is accurate to within USEPA established tolerances listed in the QAPP. A complete copy of all calibration/QC check data, independent QA performance audits, and technical systems audits is included in Appendix C and are summarized below.

2.5.1 Instrument Calibration Statistics

A description of quarterly calibration/QC checks is presented below by quarter. These quarterly calibration/QC check descriptions are summarized in **Tables 2-7** through **2-10** for each measurement parameter during the monitoring year. Summarized results characterize an as-left instrument state. If as-found results were significantly different or failed QA criteria, they are discussed below and as part of the summary table.

2.5.1.1 Second Quarter 2006

The second quarter calibration of the air quality measurement systems was conducted by AECOM June 7 through 8, 2006. Results of this QA activity are summarized in **Table 2-7**, which shows all air quality systems were reporting measurements to within acceptable limits, except for the as-found calibration for the TECO 43C SO_2 analyzer that was slightly outside acceptable limits. An adjustment was made to the SO_2 analyzer and the post-adjustment calibration indicated the analyzer was operating within acceptable limits.

During independent QA audit checks, the wind direction and wind speed sensor starting thresholds were found to be high, but within acceptable limits; therefore, maintenance was conducted on both sensors. Post-maintenance checks conducted with the auditors' equipment showed both sensors to be operating within acceptable limits.

2.5.1.2 Third Quarter 2006

The third quarter calibration of the air quality measurement systems was conducted by AECOM on September 11 through 12, 2006. Results of this QA activity are summarized in **Table 2-8**, which shows all air quality and meteorological systems were reporting measurements to within acceptable limits.

2.5.1.3 Fourth Quarter 2006

The fourth quarter air quality measurement system calibration was conducted by AECOM from December 11 through 14, 2006. Results of this QA activity are summarized in **Table 2-9**, which shows all air quality systems were reporting measurements to within acceptable limits, except for the O_3 calibration, which was not checked. The O_3 primary standard instrument model 49PS was found inoperable and required troubleshooting and repair. Based on low flow throughputs, the pump for this instrument was rebuilt and flow returned to required specifications. Also, both lamp frequencies were found to be low (45 kHz) and lamp adjustment shutters were adjusted to return detector frequencies to 75 kHz as specified in the instrument manual. Though the instrument returned to normal operation, the amount of frequency drift and expired certification rendered the instrument questionable as a reference standard; therefore no O_3 calibration was performed. The O_3 instrument passed audit tests during this quarter, the previous quarter, and subsequent quarter bracketing this data and passed calibration tests in third quarter 2006 thus resulting in no data invalidation. The potentiometer in the wind direction sensor was found to be misaligned due to a loose retaining bolt. The bolt was tightened and the instrument recalibrated to within specifications.

2.5.1.4 First Quarter 2007

The first quarter air quality and meteorological measurement system calibration was conducted by AECOM from March 5 through 7, 2006. Results of this QA activity are summarized in **Table 2-10**, which shows all air quality and meteorological systems were reporting measurements to within acceptable limits, except for solar radiation, O_3 and PM_{10}, which were not checked. The O_3 measurement system could not be calibrated because the O_3 primary standard system was offline. The PM_{10} O_3 calibration check was not properly documented to be considered a valid calibration. The PM_{10} instrument passed bracketing calibrations in the previous and subsequent quarters resulting in no data invalidation. The solar radiation measurement system could not be calibrated due to insufficient solar radiation. Otherwise, all air quality and meteorological systems were reporting measurements to within acceptable limits

2.5.2 Deviations from the QAPP

The PM_{10} instrument calibration was not completed in the first quarter of 2007 due to the fact it was not properly documented. The instrument passed the bracketing calibrations and audits in the previous and subsequent quarters and thus no data was invalidated. The O_3 primary standard was inoperable in the fourth quarter of 2006 and first quarter of 2007 and thus the O_3 instrument could not be calibrated. The instrument passed audit checks during these quarters and bracketing calibrations in previous and subsequent quarters resulting in no data invalidation. Otherwise, there were no deviations from the QAPP procedures.

2.5.3 Independent Quality Assurance Audits

A written description of quarterly independent QA performance audits and the technical systems audit is presented below. Quarterly performance audit results are also summarized in **Tables 2-11** through **Table 2-14** for each measurement parameter.

2.5.3.1 Second Quarter 2006

The second quarter 2006 air quality and meteorological measurement system performance audit was conducted by Air Monitoring Services and Technology (AMSTech) June 7 through 8, 2006. Audit results showed all systems were reporting measurements to within required accuracy limits.

Table 2-7 Second Quarter 2006 Calibration Results

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Calibration June 7 through 8, 2006					
SO_2	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	The calibration confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	0.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO_X	Slope	≥ 0.85 and ≤ 1.15	0.97	Pass	
	Intercept	≤ ±3% full scale	0.82%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	0.98	Pass	
	Intercept	≤ ±3% full scale	0.76%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	100%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	0.37%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	-1.1%	Pass	
	Total Flow	≤ ±10%	-1.6%	Pass	
	Mass Determination	≤ ±2.5%	0.57%	Pass	
Meteorological Calibration June 7 through 8, 2006					
10-m Horizontal Wind Speed	Accuracy	≤ ±5%	0.0%	Pass	A non-mandatory calibration confirmed the wind speed and wind direction systems were reporting measurements to within acceptable limits. * A full calibration of the meteorological monitoring system was scheduled for the third quarter 2006.
	Starting Torque	≤ 1 g-cm	0.2 g-cm	Pass	
10-m Horizontal Wind Direction	Accuracy	≤ ±5 deg.	0.0 deg.	Pass	
	Linearity	≤ ±3 deg.	N/A	N/A	
	Starting Torque	≤ 11.0 g-cm	2.0 g-cm	Pass	
10-m Vertical Wind Speed	Accuracy	≤ ±2.5 m/s	*	*	
	Starting Torque	≤ 1 g-cm	*	*	
10-m Temperature	Accuracy	≤ ±0.5 °C	*	*	
2-m Temperature	Accuracy	≤ ±0.5 °C	*	*	
10-2m Temperature Lapse	Accuracy	≤ ±0.1 °C	*	*	
Total Solar Radiation	Accuracy	≤ ±25 W/m^2	*	*	

Table 2-8 Third Quarter 2006 Calibration Results

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Calibration September 11 through 12, 2006					
SO_2	Slope	≥ 0.85 and ≤ 1.15	1.1	Pass	The calibration confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	-0.18%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_X	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	-0.70%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	1.01	Pass	
	Intercept	≤ ±3% full scale	-0.84%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	101%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	0.32%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
PM_{10}	Sample Flow	≤ ±10%	-0.3%	Pass	
	Total Flow	≤ ±10%	-0.7%	Pass	
	Mass Determination	≤ ±2.5%	0.44%	Pass	
Meteorological Calibration September 11 through 12, 2006					
10-m Horizontal Wind Speed	Accuracy	≤ ±5%	0.0%	Pass	The calibration confirmed all meteorological systems were reporting measurements to within acceptable limits.
	Starting Torque	≤ 1 g-cm	0.3 g-cm	Pass	
10-m Horizontal Wind Direction	Accuracy	≤ ±5 deg.	-0.56 deg.	Pass	
	Linearity	≤ ±3 deg.	0.0 deg.	Pass	
	Starting Torque	≤ 11.0 g-cm	10.0 g-cm	Pass	
10-m Vertical Wind Speed	Accuracy	≤ ±2.5 m/s	0.040 m/s	Pass	
	Starting Torque	≤ 1 g-cm	0.2 g-cm	Pass	
10-m Temperature	Accuracy	≤ ±0.5 °C	0.07 °C	Pass	
2-m Temperature	Accuracy	≤ ±0.5 °C	0.02 °C	Pass	
10-2m Temperature Lapse	Accuracy	≤ ±0.1 °C	0.03 °C	Pass	
Total Solar Radiation	Accuracy	≤ ±25 W/m^2	4.3 W/m^2	Pass	

Table 2-9 Fourth Quarter 2006 Calibration Results

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Calibration December 11 through 12, 2006					
SO_2	Slope	≥ 0.85 and ≤ 1.15	1.02	Pass	The calibration confirmed all air quality systems were reporting measurements to within acceptable limits, except for O_3. * The O_3 instrument could not be calibrated because the measurement system primary standard was offline for repairs.
	Intercept	≤ ±3% full scale	0.06%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO_X	Slope	≥ 0.85 and ≤ 1.15	1.01	Pass	
	Intercept	≤ ±3% full scale	-0.06%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	1.01	Pass	
	Intercept	≤ ±3% full scale	-0.01%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO_2	Converter Eff.	≥ 96%	100%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	*	*	
	Intercept	≤ ±3% full scale	*	*	
	Correlation Coef.	≥ 0.9950	*	*	
PM_{10}	Sample Flow	≤ ±10%	0.6%	Pass	
	Total Flow	≤ ±10%	-0.6%	Pass	
	Mass Determination	≤ ±2.5%	1.39%	Pass	
Meteorological Calibration					
Conducting a calibration of meteorological measurement systems is required semiannually and was conducted during the third calendar quarter 2006 and first calendar quarter of 2007.					

Table 2-10 First Quarter 2007 Calibration Results

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Calibration March 5 through 6, 2007					
SO_2	Slope	≥ 0.85 and ≤ 1.15	1.02	Pass	The calibration confirmed all air quality systems were reporting measurements to within acceptable limits, except for O_3.and PM_{10} * The O_3 instrument could not be calibrated because the measurement system primary standard was offline for repairs. # The calibration check on the PM_{10} instrument was not properly documented and the calibration was not valid.
	Intercept	≤ ±3% full scale	-0.02%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO_X	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	0.75%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	0.66%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO_2	Converter Eff.	≥ 96%	100%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	*	*	
	Intercept	≤ ±3% full scale	*	*	
	Correlation Coef.	≥ 0.9950	*	*	
PM_{10}	Sample Flow	≤ ±10%	#	#	
	Total Flow	≤ ±10%	#	#	
	Mass Determination	≤ ±2.5%	#	#	
Meteorological Calibration March 5 through 6, 2007					
10-m Horizontal Wind Speed	Accuracy	≤ ±5%	0.0%	Pass	The calibration confirmed all meteorological systems were reporting measurements to within acceptable limits. * The solar radiation measurement system could not be calculated due to insufficient solar radiation.
	Starting Torque	≤ 1 g-cm	0.3 g-cm	Pass	
10-m Horizontal Wind Direction	Accuracy	≤ ±5 deg.	1.75 deg.	Pass	
	Linearity	≤ ±3 deg.	0.0 deg.	Pass	
	Starting Torque	≤ 11.0 g-cm	8.0 g-cm	Pass	
10-m Vertical Wind Speed	Accuracy	≤ ±2.5 m/s	0.0 m/s	Pass	
	Starting Torque	≤ 1 g-cm	0.2 g-cm	Pass	
10-m Temperature	Accuracy	≤ ±0.5 °C	0.08 °C	Pass	
2-m Temperature	Accuracy	≤ ±0.5 °C	0.09 °C	Pass	
10-2m Temperature Lapse	Accuracy	≤ ±0.1 °C	-0.03 °C	Pass	
Total Solar Radiation	Accuracy	≤ ±25 W/m^2	*	*	

Table 2-11 Second Quarter 2006 Audit Results

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Audit June 7 through 8, 2006					
SO_2	Slope	≥ 0.85 and ≤ 1.15	0.92	Pass	The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	-2.2%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_X	Slope	≥ 0.85 and ≤ 1.15	0.88	Pass	
	Intercept	≤ ±3% full scale	-2.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	0.89	Pass	
	Intercept	≤ ±3% full scale	-2.2%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	99.8%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	0.98	Pass	
	Intercept	≤ ±3% full scale	0.8%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	-0.3%	Pass	
	Total Flow	≤ ±10%	-1.4%	Pass	
	Mass Determination	≤ ±2.5%	0.84%	Pass	
Meteorological Audit June 7 through 8, 2005					
10-m Horizontal Wind Speed	Accuracy	≤ ±5%	0.0%	Pass	The audit confirmed all meteorological systems were reporting measurements to within acceptable limits.
	Starting Torque	≤ 1 g-cm	0.3 g-cm	Pass	
10-m Horizontal Wind Direction	Accuracy	≤ ±5 deg.	3.0 deg.	Pass	
	Linearity	≤ ±3 deg.	0.3 deg.	Pass	
	Starting Torque	≤ 11.0 g-cm	9.0 g-cm	Pass	
10-m Vertical Wind Speed	Accuracy	≤ ±2.5 m/s	0.03 m/s	Pass	
	Starting Torque	≤ 1 g-cm	0.2 g-cm	Pass	
10-m Temperature	Accuracy	≤ ±0.5 °C	0.22 °C	Pass	
2-m Temperature	Accuracy	≤ ±0.5 °C	0.25 °C	Pass	
10-2m Temperature Lapse	Accuracy	≤ ±0.1 °C	0.05 °C	Pass	
Total Solar Radiation	Accuracy	≤ ±5% full scale	1.1%	Pass	

Table 2-12 Third Quarter 2006 Audit Results

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Audit September 12 , 2006					
SO_2	Slope	≥ 0.85 and ≤ 1.15	0.96	Pass	The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	-0.4%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_X	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	-0.6%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	-0.6%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	99.7%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	1.03	Pass	
	Intercept	≤ ±3% full scale	-0.6%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	-2.3%	Pass	
	Total Flow	≤ ±10%	-3.9%	Pass	
	Mass Determination	≤ ±2.5%	0.96%	Pass	
Meteorological Audit					
Total Solar Radiation	Accuracy	≤ ±5% full scale	1.1%	Pass	
Conducting a meteorological measurement systems audit is required semiannually and was conducted during the second and fourth calendar quarters of 2006. The solar radiation sensor was audited in anticipation of insufficient light during the fourth quarter for auditing the sensor.					

Table 2-13 Fourth Quarter 2006 Audit Results

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Audit December 13 through 14, 2006					
SO_2	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	-0.2%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_X	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	0.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	-0.2%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	99.7%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	-0.4%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	0.0%	Pass	
	Total Flow	≤ ±10%	0.12%	Pass	
	Mass Determination	≤ ±2.5%	0.78%	Pass	
Meteorological Audit December 13 through 14, 2006					
10-m Horizontal Wind Speed	Accuracy	≤ ±5%	0.0%	Pass	The audit confirmed all meteorological systems that could be audited were reporting measurements to within acceptable limits. * A solar radiation audit could not be conducted due to low sun angles during this time of year.
	Starting Torque	≤ 1 g-cm	0.1 g-cm	Pass	
10-m Horizontal Wind Direction	Accuracy	≤ ±5 deg.	2.8 deg.	Pass	
	Linearity	≤ ±3 deg.	0.8 deg.	Pass	
	Starting Torque	≤ 11.0 g-cm	6.0 g-cm	Pass	
10-m Vertical Wind Speed	Accuracy	≤ ±2.5 m/s	0.03 m/s	Pass	
	Starting Torque	≤ 1 g-cm	0.2 g-cm	Pass	
10-m Temperature	Accuracy	≤ ±0.5 °C	0.07 °C	Pass	
2-m Temperature	Accuracy	≤ ±0.5 °C	0.08 °C	Pass.	
10-2m Temperature Lapse	Accuracy	≤ ±0.1 °C	0.06 °C	Pass	
Total Solar Radiation	Accuracy	≤ ±5% full scale	*	*	

Table 2-14 First Quarter 2007 Audit Results

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Audit March 5 through 6, 2007					
SO_2	Slope	≥ 0.85 and ≤ 1.15	0.94	Pass	The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	0.4%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_X	Slope	≥ 0.85 and ≤ 1.15	0.94	Pass	
	Intercept	≤ ±3% full scale	0.2%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	0.95	Pass	
	Intercept	≤ ±3% full scale	0.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	99.5%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	-0.6%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	3.1%	Pass	
	Total Flow	≤ ±10%	1.8%	Pass	
	Mass Determination	≤ ±2.5%	1.2%	Pass	
Meteorological Audit					
Conducting meteorological measurement systems audit is required semiannually and was conducted during the fourth 2006 and second calendar quarter of 2007.					

2.5.3.2 Third Quarter 2006

The third quarter 2006 performance audit of the air quality measurement systems was conducted by AMSTech September 12, 2006. Audit results showed all systems were reporting measurements to within required accuracy limits.

2.5.3.3 Fourth Quarter 2006

The fourth quarter 2006 performance audit of the air quality and meteorological measurement systems was conducted by AMSTech December 13 through 14, 2006. Audit results showed all systems were reporting measurements to within required accuracy limits, except for solar radiation, which could not be measured due to low sun angles during this time of year.

2.5.3.4 First Quarter 2007

The first quarter 2007 performance audit of the air quality measurement systems was conducted by AMSTech on March 5 through 6, 2007. Audit results showed all systems were reporting measurements to within required accuracy limits.

2.5.3.5 Technical Systems Audit

The annual Technical Systems Audit (TSA) of data handling, validation, processing, reporting procedures, and monitoring station siting and operation at the Nuiqsut Station and at the AECOM Air Resources Laboratory in Fort Collins, Colorado, was conducted during May 2007. This occurred approximately 5 weeks after the end of the 2006 monitoring year on March 31, 2007. TSA results showed the monitoring station has been installed and is operating in accordance with the QAPP and USEPA recommended guidelines. The audit also showed AECOM has the necessary organization, practical field experience, work facilities, and data processing procedures in place to accurately collect and report project ambient air quality and meteorological data.

3.0 Monitoring Data Network Summary

3.1 Air Quality Data Summary

Criteria pollutants monitored as part of the Monitoring Program are NO_2, SO_2, respirable PM_{10}, and O_3. Criteria pollutants are those air pollutants for which ADEC and USEPA have established standards that provide a threshold above which risk to public health and welfare becomes an issue. These standards are referred to as the Alaska Ambient Air Quality Standards (AAAQS) and are the same as the national standards for the pollutants measured. Applicable AAAQS, along with ambient concentrations measured at the Nuiqsut Station, are presented in **Tables 3-1** through **3-4** and summarized by pollutant below.

3.1.1 Nitrogen Dioxide

Table 3-1 shows the annual average NO_2 concentration was 0.001 ppm, and less than 2 percent of the annual NO_2 AAAQS of 0.053 ppm. The typical NO_2 concentrations are just above instrument detection level. The annual average measured this year is lower than the historical Nuiqsut Station average of 0.004 ppm.

Table 3-1 Measured Nitrogen Dioxide Data Summary, 2006 Annual Data Summary

Monitoring Period	Year	Period Mean (ppm)	Number of Exceedances
2nd Qtr.	2006	0.001	None
3rd Qtr.	2006	0.001	None
4th Qtr.	2006	0.001	None
1st Qtr.	2007	0.003	None
Annual	2006	0.001	None

NAAQS/AAAQS: Annual - 0.053 ppm (100 µg/m^3) – Compared to the annual arithmetic mean.

The distribution of average hourly NO_2 concentration by wind direction this year was typical of past years with the magnitude of the highest values lower than the historical average (**Figure 3-1)**. This offset in magnitude is consistent with the difference between the historical and current year's annual average of the hourly concentrations. As shown in **Figure 3-1**, historically, the lowest concentrations are measured when winds transport background air to the Nuiqsut Station (west-southwest clockwise through east-southeast). Slightly higher concentrations occur for wind directions that place the station downwind of Nuiqsut (southeast clockwise through southwest wind directions). In general, measured NO_2 concentrations at Nuiqsut are extremely low.

Monthly average NO_2 concentrations are presented in **Figure 3-2**. For this monitoring year, the trend of monthly averaged measured concentrations showed less seasonal variation. Historically, it is typical to observe increases in monthly averaged NO_2 concentrations during late winter. The pattern of higher measured concentrations in late winter has been attributed to differences in atmospheric dispersion characteristics between winter and summer, and potential changes in local emissions. Seasonal differences in atmospheric dispersion characteristics arise because in winter, there is an increase in stable and neutral atmospheric conditions. With the sun up in summer, solar radiation and heating of the surface induces more vertical mixing of the lower atmosphere than in winter, thereby increasing air pollution dispersion. In winter, without the benefit of solar energy, the atmosphere remains relatively stable reducing vertical pollution dispersion. In addition, the increased local use of heating systems and idling vehicles in winter contribute to the NO_2 load.

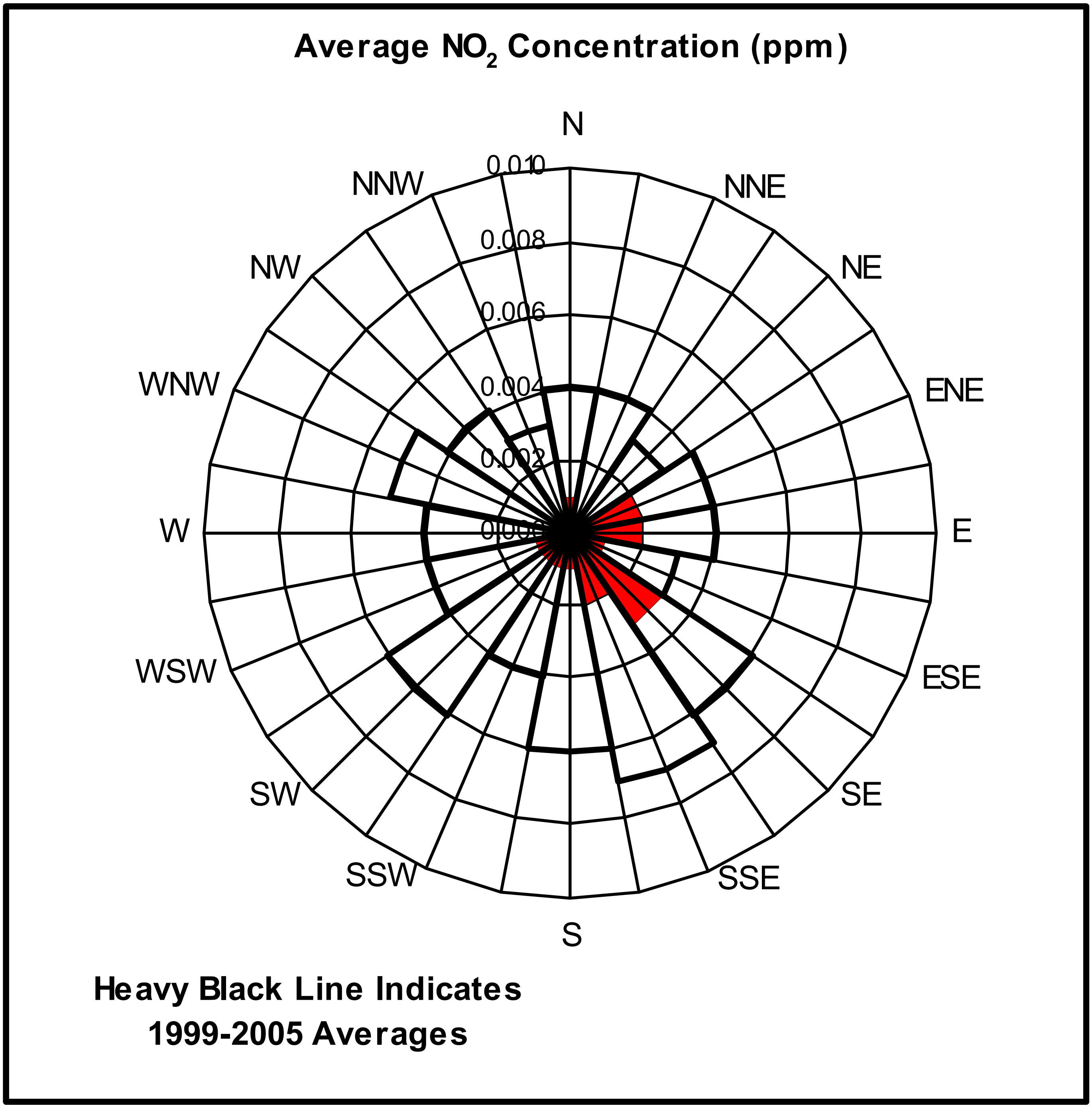


Figure 3-1 Average NO_2 Concentration by Wind Direction, 2006 Annual Data Summary

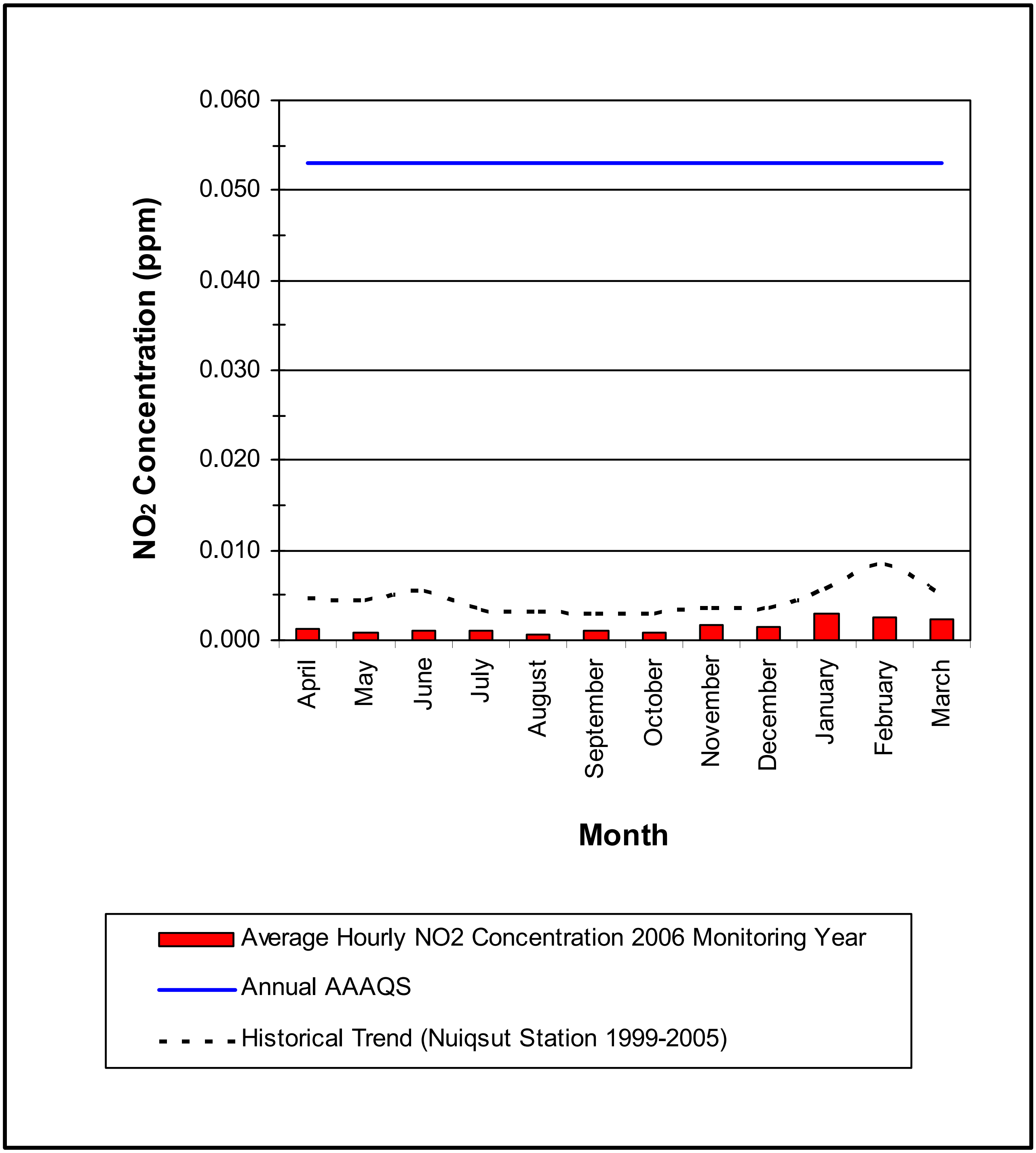


Figure 3-2 Average NO_2 Concentration by Month, 2006 Annual Data Summary

3.1.2 Sulfur Dioxide

Table 3-2 lists measured maximum 3-hour (running), 24-hour (midnight-to-midnight), and the annual average hourly SO_2 concentrations measured this monitoring year. Concentrations for all averaging periods were near or below instrument detection limit and well below applicable AAAQS. Measured SO_2 concentrations were typical of historical (1999-2005) values.

Table 3-2 Measured Sulfur Dioxide Data Summary 2006 Annual Data Summary

Monitoring Period	Year	3-hour (ppm)		24-hour (ppm)		Period Mean (ppm)	Number of Exceedances
		1st high	2nd high	1st high	2nd high		
2nd Qtr.	2006	0.002	0.002	0.002	0.001	0.001	None
3rd Qtr.	2006	0.001	0.001	0.000	0.000	0.000	None
4th Qtr.	2006	0.002	0.001	0.001	0.001	0.000	None
1st Qtr.	2007	0.002	0.002	0.002	0.001	0.000	None
Annual	2006	0.002	0.002	0.002	0.002	0.000	None

NAAQS/AAAQS:

- 3-hour - 0.5 ppm (1,300 μg/m^3) – Rolling average not to be exceeded more than once per year.
- 24-hour - 0.14 ppm – Midnight to midnight average not to be exceeded more than once per year.
- Annual - 0.03 ppm – Compared to the annual arithmetic mean.

Measured 3-hour average SO_2 concentrations were less than 0.003 ppm throughout the monitoring year. The majority of measured SO_2 concentrations were just above the instrument detection limit making it difficult to discuss significant trends. Simply, there was no single near-field or far-field measurable SO_2 source observed in the data collected this year. Without identifiable sources, measured concentrations are representative of a regional or global background signature. The low average concentrations measured are consistent with an airshed containing relatively few and widely distributed sources. This trend has been typical of SO_2 measurements since monitoring began.

3.1.3 Respirable Particulate Matter (PM_{10})

Throughout the monitoring project history, the majority of elevated measured PM_{10} concentrations appear to result from naturally occurring windblown fugitive dust from exposed or disturbed areas local to the Nuiqsut Station. Exposed areas identified in the program are:

- The exposed bank of the Nechelik Channel north-northeast clockwise through east-southeast of the station;
- The exposed gravel mining area southeast of the station;
- Disturbed ground due to residential construction along the utility right-of-way and road southeast clockwise through south-southeast of the station; and
- To a lesser degree, disturbed ground associated with dirt roads within Nuiqsut south clockwise through west-southwest of the station.

In addition to these local fugitive sources, in the past, elevated particulate has also been measured from remote forest and tundra fires. However, during the current monitoring year, there were no periods identified when measured particulate concentrations were clearly impacted by forest fires. When particulate from local fugitive dust and smoke is not present (e.g., during winter), hourly concentrations decrease to near the PSD de minimus levels.

Respirable particulate matter less than 10 µm in diameter (PM_{10}) measured at USEPA standard temperature and pressure, has a 24-hour and annual AAAQS of 150 µg/m^3 and 50 µg/m^3, respectively. As listed in **Table 3-3**, the maximum 24-hour PM_{10} concentration measured during the monitoring year was 132.9 µg/m^3. The yearly average PM_{10} concentration was 8.8 µg/m^3. This is well below the annual AAAQS of 50 µg/m^3, and consistent with the historical Nuiqsut Station average of 7.6 µg/m^3.

Table 3-3 Measured PM_{10} Data Summary, 2006 Annual Data Summary

Monitoring Period	Year	24-hour (µg/m^3)		Period Mean (µg/m^3)	Number of Exceedances
		1st high	2nd high		
2nd Qtr.	2006	25.3	25.1	8.4	None
3rd Qtr.	2006	132.9	76.7	12.1	None
4th Qtr.	2006	84.8	76.9	8.4	None
1st Qtr.	2007	29.9	17.2	5.8	None
Annual	2006	132.9	84.8	8.8	None

NAAQS/AAAQS:

- 24-hour – 150 µg/m3 – Not to be exceeded more than once per year measured from midnight to midnight at USEPA Standard Conditions.
- Annual – 50 µg/m3 – Compared to the 3-year average of the weighted annual arithmetic mean concentration measured at USEPA Standard Conditions.

Figure 3-3 shows annual average hourly PM_{10} concentrations by wind direction measured this year compared to the historical trend. Except for higher concentrations associated with northeasterly clockwise through easterly wind directions and south clockwise through south-southwest directions, concentrations were similar to historical annual averages. Directional dependence is related to influence of local fugitive dust sources discussed previously. Anomalously high averages associated with northeasterly through easterly wind directions appear to be related to the dust sources previously discussed.

Figure 3-4 compares the monthly average hourly PM_{10} concentrations measured this year to Nuiqsut Station historical monthly average PM_{10} concentrations. Historical trends show the fourth and first calendar quarters (October through March) typically experience the lowest average hourly PM_{10} concentrations reflecting snow covered conditions that suppress fugitive dust. In contrast, the second and third calendar quarters (April through September) record higher average hourly concentrations as fugitive dust sources become exposed and active. Average hourly concentrations reported by month this year generally followed this trend. In July, concentrations from the dust events previously discussed caused anomalously high hourly concentrations as compared to previous years. The variability seen throughout this year and compared to previous years is expected considering PM_{10} concentrations are highly dependent on the interplay of many meteorological characteristics such as wind speed and frequency, precipitation, and temperature.

3.1.4 Ozone

Table 3-4 lists measured 8-hour and annual average hourly O_3 concentrations measured during the monitoring year. Since the AAAQS for O_3 is based on the 3-year average of the fourth highest measured daily maximum 8-hour average O_3 concentration, it is difficult to discuss AAAQS compliance. However, since the maximum 8-hour average O_3 concentration measured was just over half the AAAQS, it is anticipated concentrations measured at the Nuiqsut Station will be well below the AAAQS.

O_3 concentrations measured this year are typical of seasonal averages measured on the Alaskan North Slope (Prudhoe Bay, Kuparuk River Unit, and Barrow). In the absence of large combustion sources, strong frontal passages and high solar radiation, ambient O_3 levels will be spatially homogeneous and representative of a regional background.

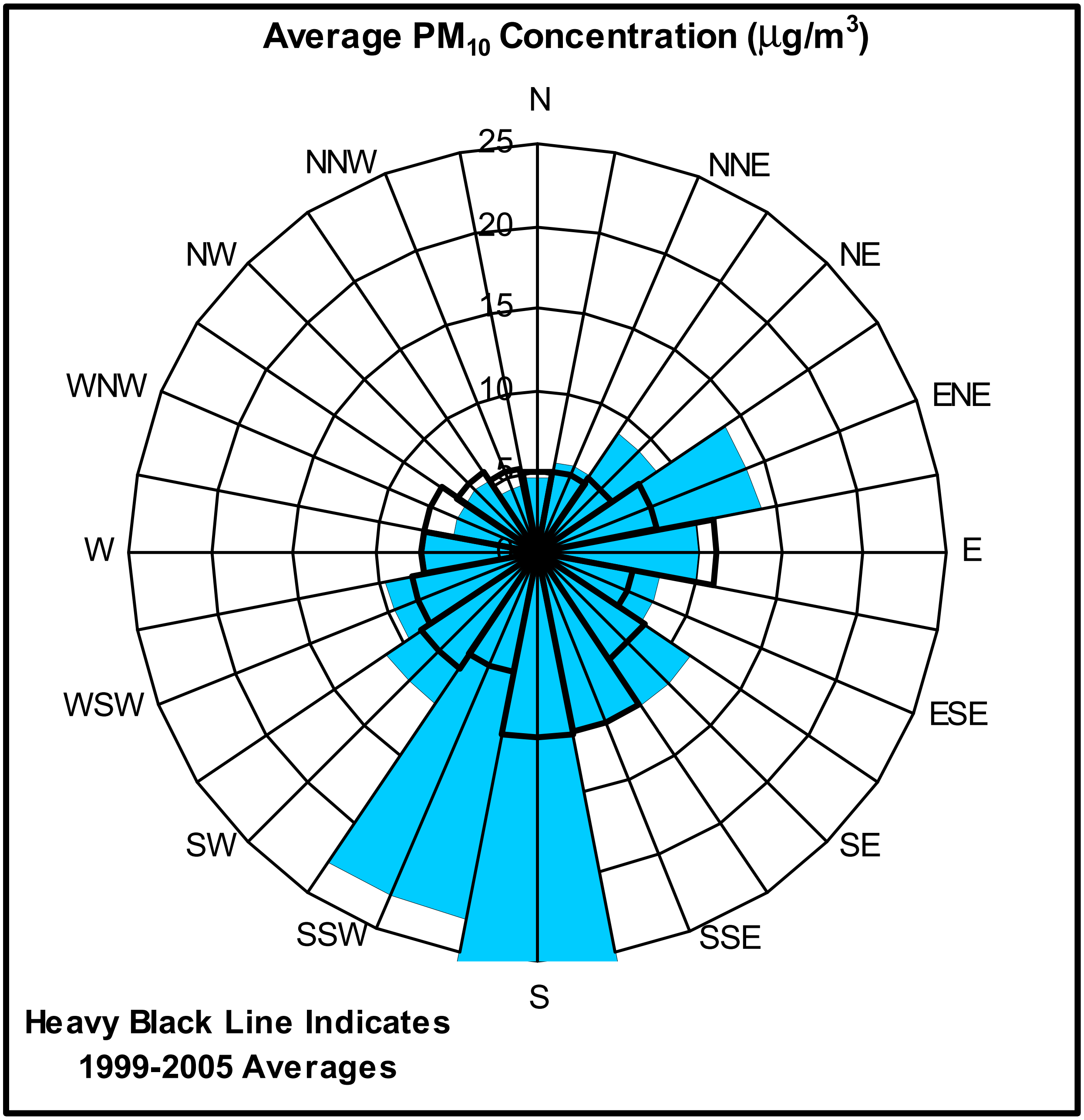
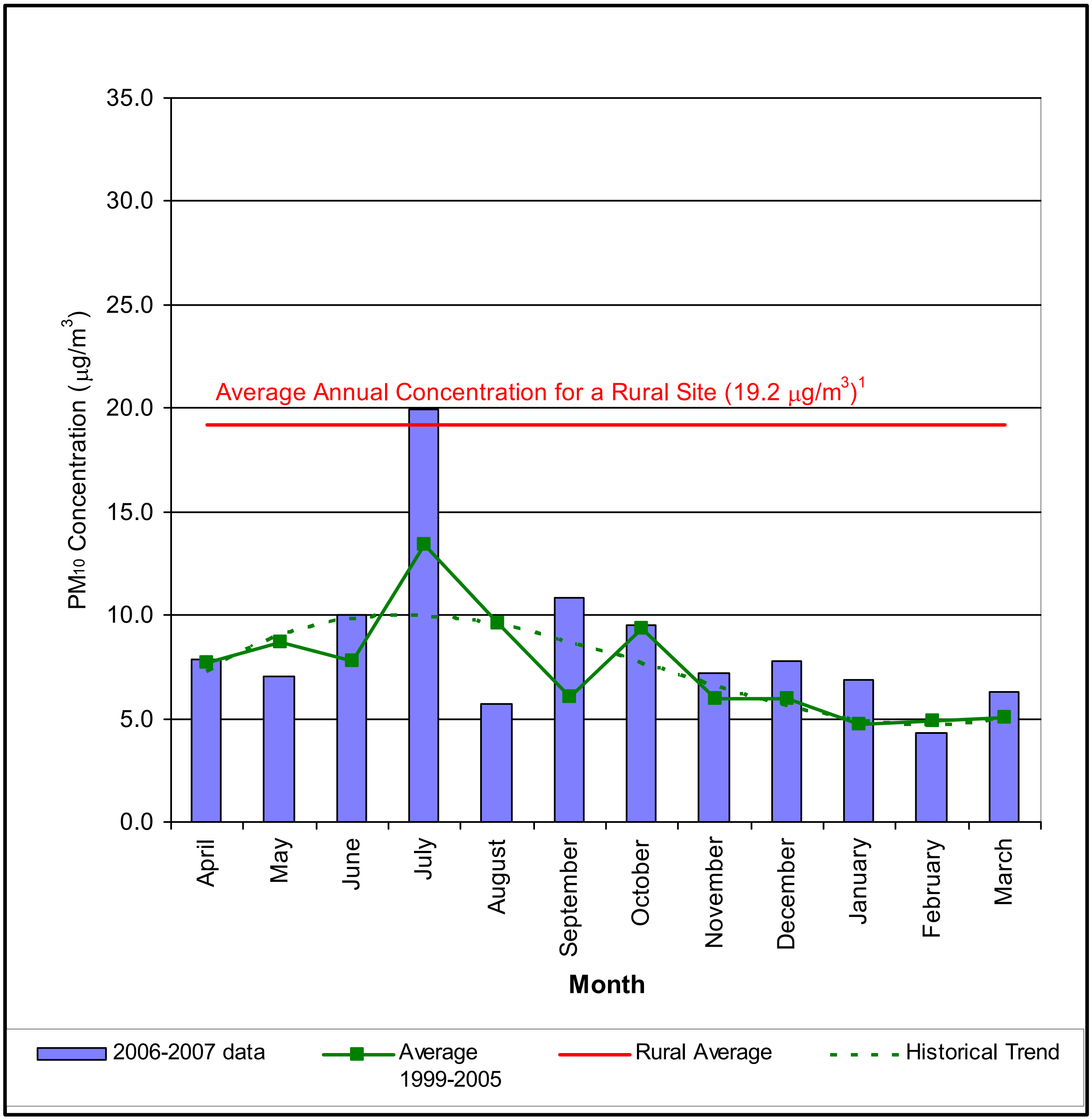


Figure 3-3 Average PM_{10} Concentration by Wind Direction, 2006 Annual Data Summary



[1] Average annual concentration obtained from 153 rural sites in the contiguous United States as summarized in the National Air Quality and Emissions Trends Report, 1999 (USEPA 2001).

Figure 3-4 Average PM_{10} Concentration by Month, 2006 Annual Data Summary

Table 3-4 Measured Ozone Data Summary, 2006 Annual Data Summary

Monitoring Period	Year	8-hour (ppm) 1st high	2nd high	4th high	Period Mean (ppm)	Number of Exceedances
2nd Qtr.	2006	0.047	0.047	0.046	0.020	None
3rd Qtr.	2006	0.026	0.026	0.026	0.016	None
4th Qtr.	2006	0.032	0.032	0.032	0.024	None
1st Qtr.	2007	0.033	0.033	0.033	0.023	None
Annual	2006	0.047	0.047	0.046	0.021	None

NAAQS/AAAQS:

- 8-hour - 0.08 ppm – Compared to the 3-year average of the fourth-highest daily maximum rolling 8-hour average concentrations.

3.2 Meteorological Data Summary

Temperature, wind speed, and wind direction data collected at the Nuiqsut Station during the monitoring year are summarized in the following subsections. Vertical wind speed and solar radiation data are also collected at the Nuiqsut Station, but are not specifically discussed in this section.

3.2.1 Wind Speed and Direction Climatology

The annual Nuiqsut bivariate wind frequency distribution (wind rose) is presented in **Figure 3-5**. Data presented in this figure is consistent with the established North Slope wind climatology and typical of the Nuiqsut bimodal wind direction distribution demonstrated every year since monitoring began. This figure shows winds during the monitoring year were dominated by northeast clockwise through easterly (NE-E) and to a lesser degree south-southwest clockwise through westerly (SSW-W). Winds from these two sectors occurred nearly 80 percent of the total hours this year and are caused by persistent regional weather patterns. Without respect to direction, the mean 10-meter wind speed for the monitoring year was 4.2 m/s and the maximum was 19.2 m/s.

The persistence of weather patterns season to season can be inferred from **Figures 3-6** through **3-9**, which present wind roses by calendar quarter. Typical of the Nuiqsut Station wind climatology, the quarterly wind roses collected this year indicate there is a persistence of NE-E all year long. SSW-W winds are present all year long but only become a significant part of the climatology during the winter months. Mean and maximum wind speeds remain fairly constant over all quarters. The quarterly wind rose depictions are augmented by **Tables 3-5** through **3-8**, which present quarterly wind rose data as a percent of valid hours. A wind rose for the fourth quarter 2006 could not be generated, because all the wind direction data for the quarter was invalidated as previously discussed. This was due to the sensor potentiometer keyway disengaging from the sensor vane. This occurred between the second semi annual audit and the second semiannual calibration.

3.2.2 Temperature Climatology

During the monitoring year, the hourly averaged 2-meter ambient temperature reached a maximum of 23.8°C (74.8°F) on June 25, 2006 and a minimum of -44.1°C (-47.4°F) on March 11, 2007. **Table 3-9** shows the monthly hourly minimum and the hourly maximum.

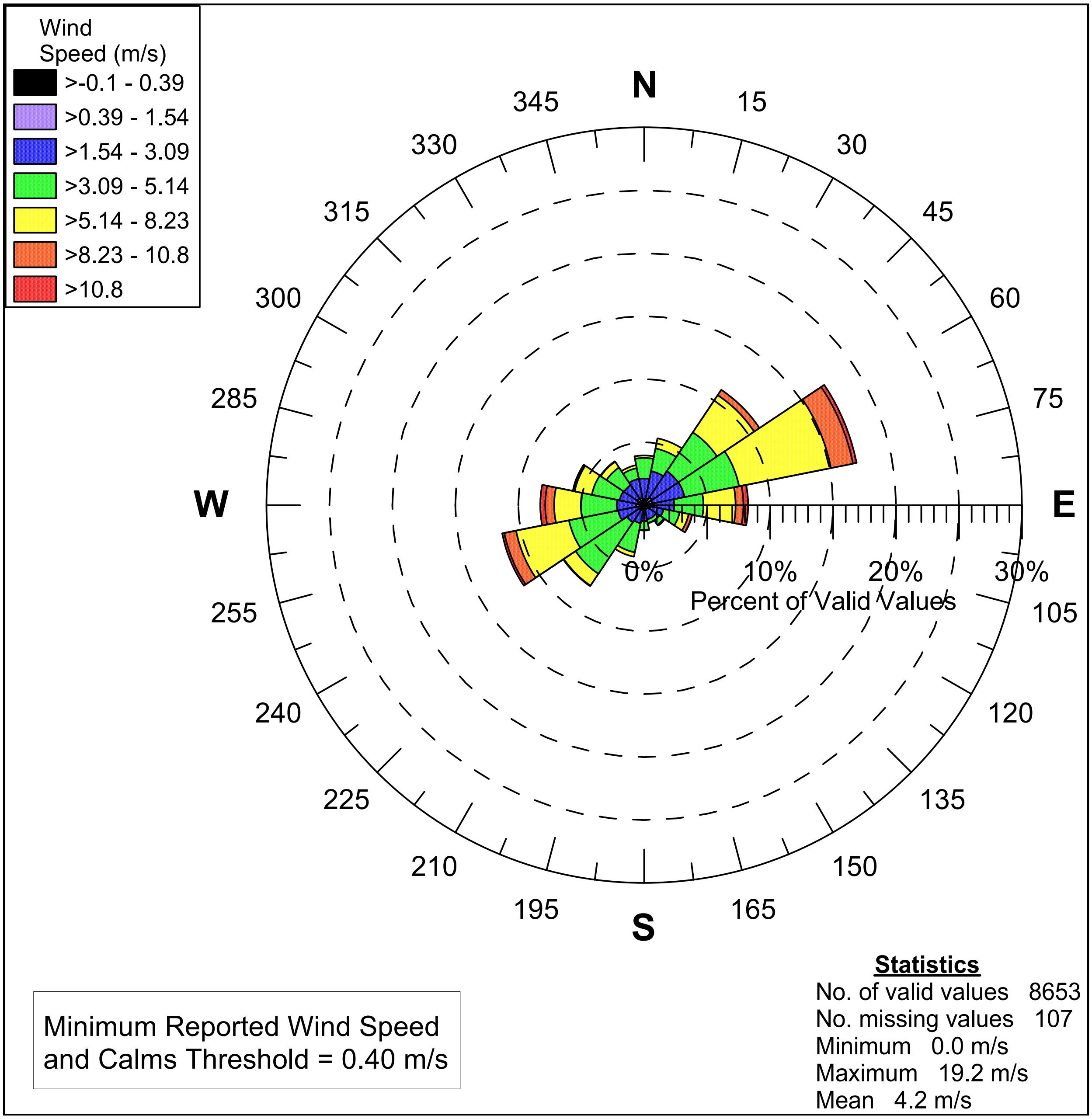


Figure 3-5 2006 Annual Nuiqsut Wind Rose

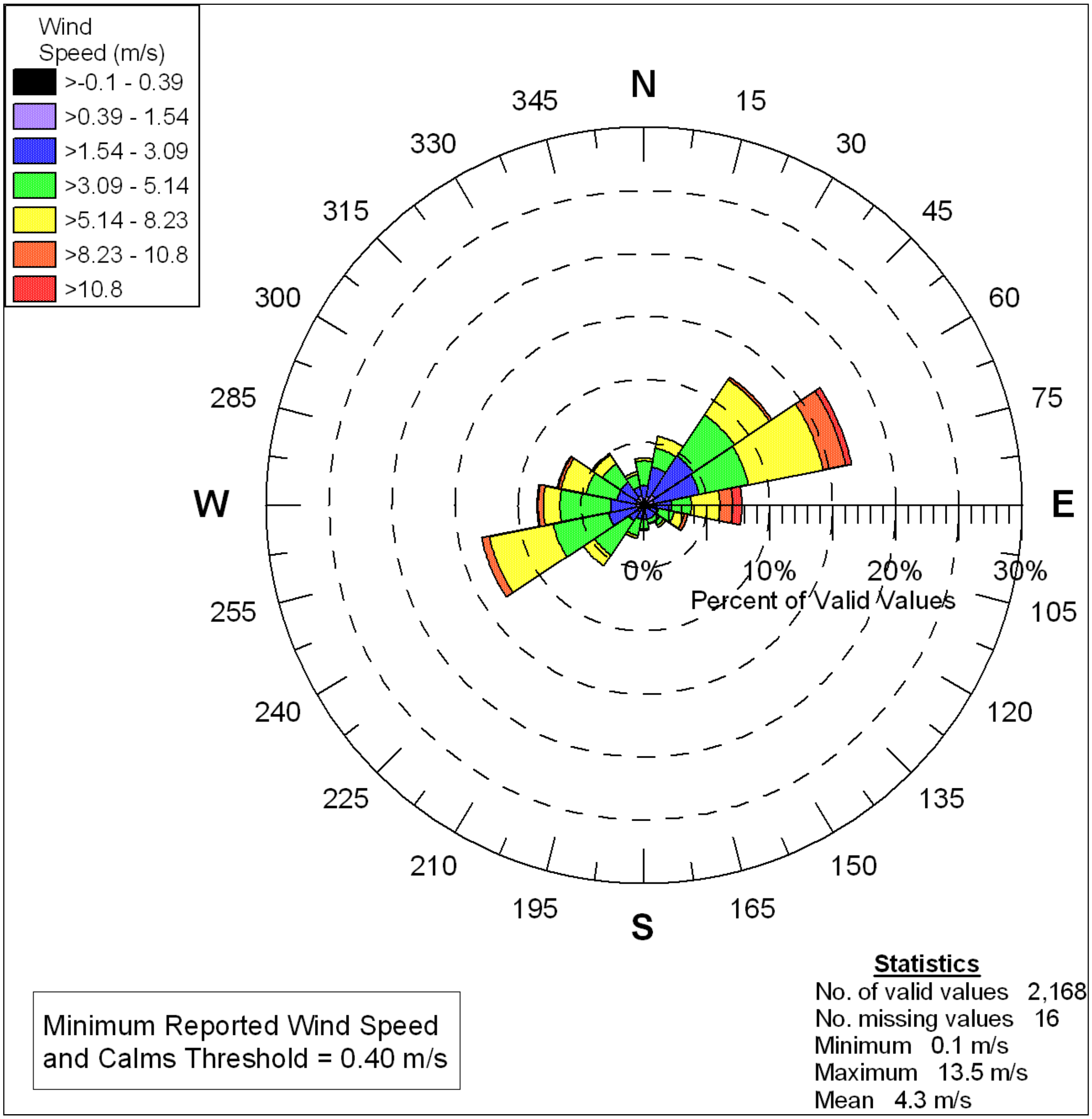


Figure 3-6 Second Quarter 2006 Nuiqsut Wind Rose

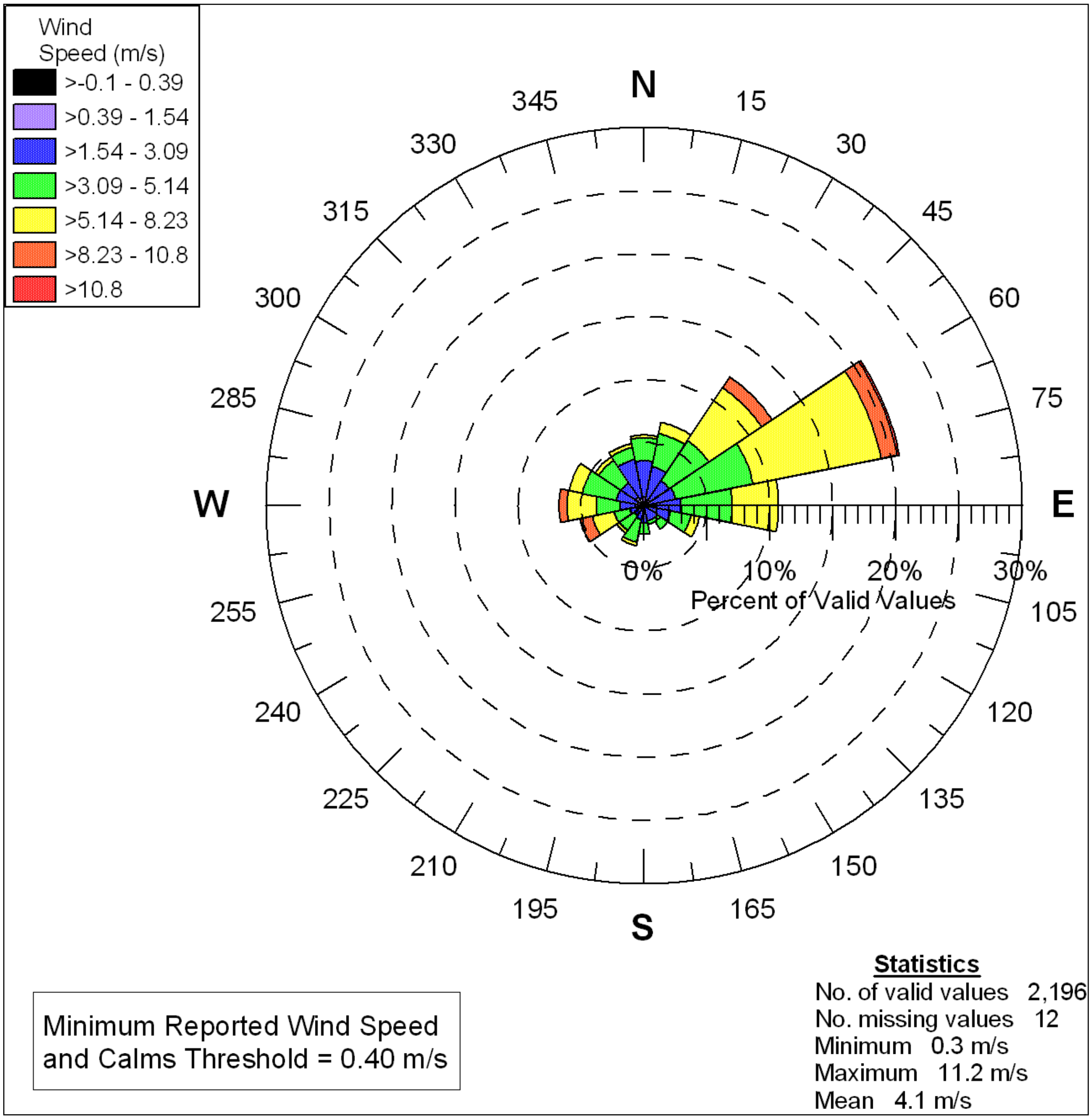


Figure 3-7 Third Quarter Nuiqsut Wind Rose

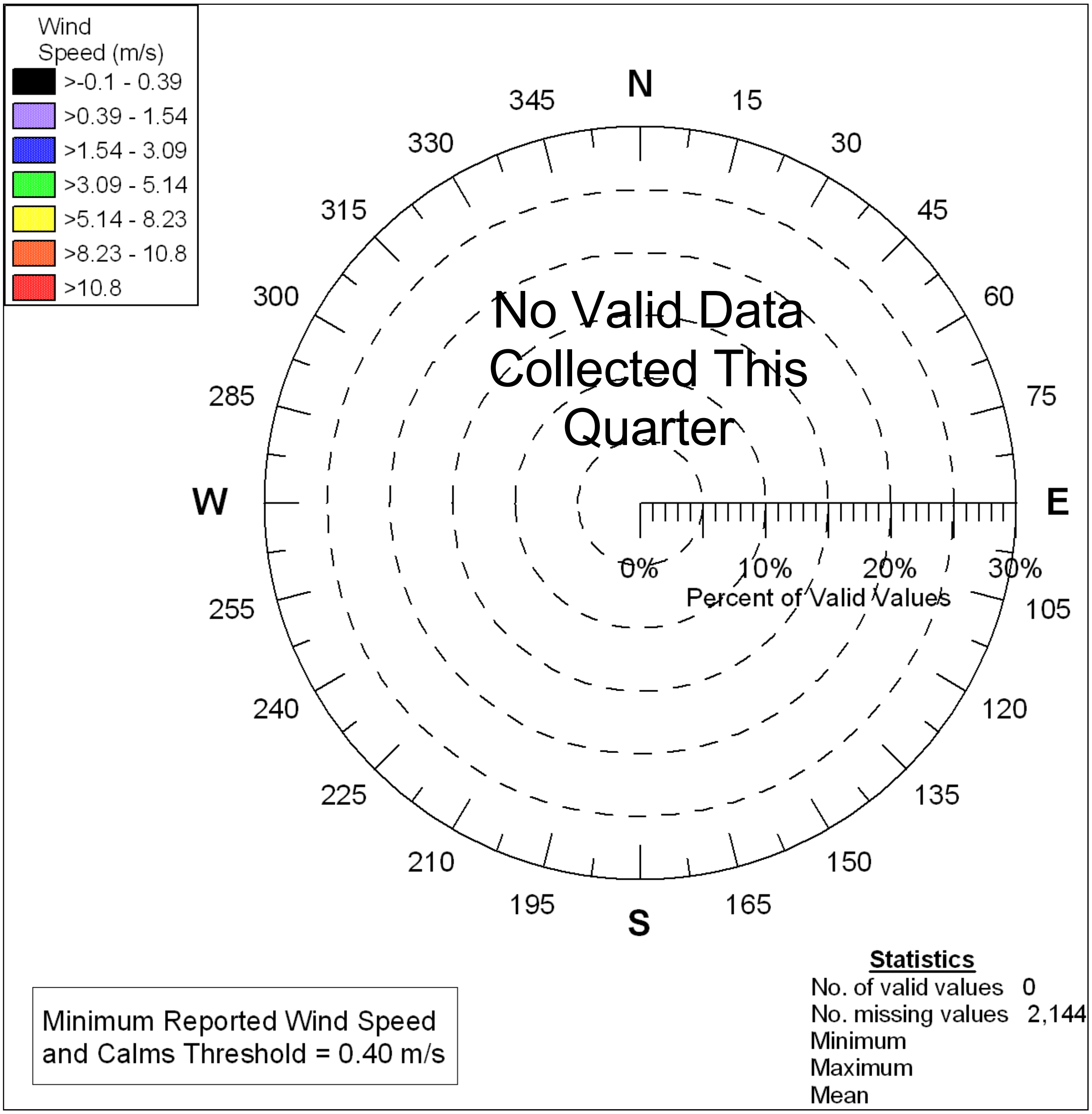


Figure 3-8 Fourth Quarter 2006 Nuiqsut Wind Rose

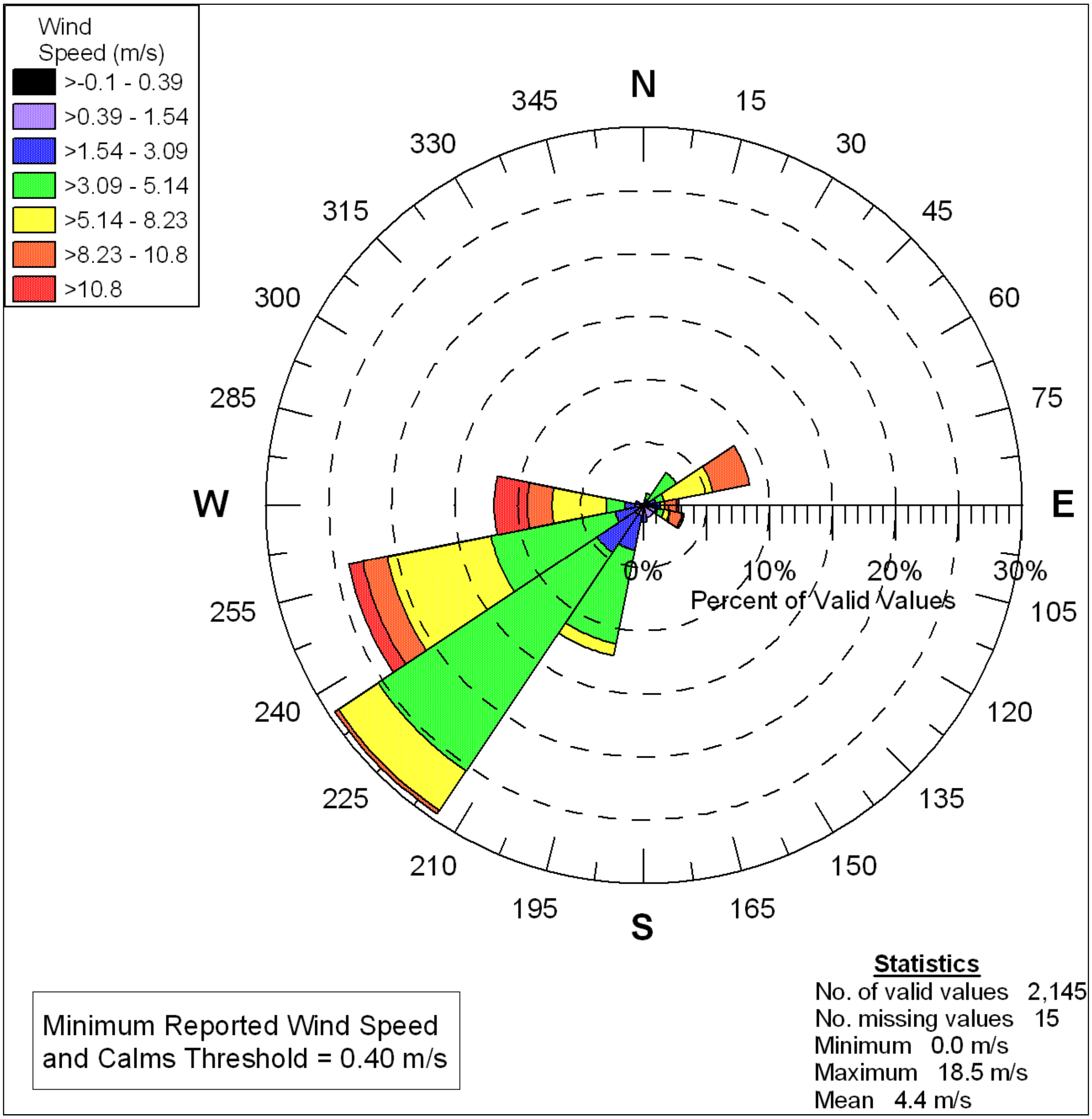


Figure 3-9 First Quarter 2007 Nuiqsut Wind Rose

Table 3-5 Second Quarter 2006 Wind Direction/Speed Frequency Analysis

Wind Rose Analysis – Percent of Valid Hourly Values (2,168 Valid Hours Used)									
Wind Direction	Wind Speed – m/s								Average Speed
	≤ 0.39	≤ 1.54	≤ 3.09	≤ 5.14	≤ 8.23	≤ 10.8	> 10.8	Total	
N		1.11	2.63	3.37	0.78	0.00	0.00	7.90	3.31
NE		1.94	7.01	7.38	6.78	1.61	0.14	24.88	4.43
E		1.43	3.18	3.60	5.72	1.66	1.06	16.67	5.32
SE		0.60	1.48	1.57	0.74	0.09	0.00	4.49	3.61
S		0.65	1.61	1.57	0.23	0.00	0.00	4.08	3.02
SW		1.06	2.08	5.77	4.29	0.28	0.00	13.49	4.49
W		1.06	4.29	8.30	4.47	1.01	0.18	19.34	4.46
NW		1.38	2.68	3.04	1.94	0.09	0.00	9.15	3.69
CALM	0.14								
Total	0.14	9.23	24.95	34.59	24.95	4.75	1.38	100	

Table 3-6 Third Quarter 2006 Wind Direction/Speed Frequency Analysis

Wind Rose Analysis – Percent of Valid Hourly Values (2,196 Valid Hours Used)									
Wind Direction	Wind Speed – m/s								Average Speed
	≤ 0.39	≤ 1.54	≤ 3.09	≤ 5.14	≤ 8.23	≤ 10.8	> 10.8	Total	
N		1.14	5.75	3.02	0.68	0.00	0.00	10.60	2.95
NE		0.97	4.21	8.94	11.22	2.28	0.06	27.68	5.21
E		1.25	4.16	7.86	9.00	0.06	0.11	22.44	4.66
SE		0.63	2.45	1.77	0.11	0.00	0.00	4.96	2.87
S		0.34	2.39	1.71	0.11	0.00	0.00	4.56	2.98
SW		0.34	1.48	3.13	1.31	0.51	0.06	6.84	4.50
W		1.25	2.51	3.70	3.99	1.08	0.00	12.54	4.70
NW		1.42	3.76	4.27	0.91	0.00	0.00	10.37	3.24
CALM	0.06								
Total	0.06	7.35	26.71	34.40	27.33	3.93	0.23	100	

Table 3-7 Fourth Quarter 2006 Wind Direction/Speed Frequency Analysis

Wind Rose Analysis – Percent of Valid Hourly Values (0 Valid Hours Used)									
Wind Direction	Wind Speed – m/s								Average Speed
	≤ 0.39	≤ 1.54	≤ 3.09	≤ 5.14	≤ 8.23	≤ 10.8	> 10.8	Total	
N		-	-	-	-	-	-	-	-
NE		-	-	-	-	-	-	-	-
E		-	-	-	-	-	-	-	-
SE		-	-	-	-	-	-	-	-
S		-	-	-	-	-	-	-	-
SW		-	-	-	-	-	-	-	-
W		-	-	-	-	-	-	-	-
NW		-	-	-	-	-	-	-	-
CALM	-								
Total	-	-	-	-	-	-	-	-	

Table 3-8 First Quarter 2007 Wind Direction/Speed Frequency Analysis

Wind Rose Analysis – Percent of Valid Hourly Values (2,145 Valid Hours Used)									
Wind Direction	Wind Speed – m/s								Average Speed
	≤ 0.39	≤ 1.54	≤ 3.09	≤ 5.14	≤ 8.23	≤ 10.8	> 10.8	Total	
N		0.00	0.16	0.00	0.00	0.00	0.00	0.19	2.22
NE		0.16	0.82	3.29	1.48	0.00	0.00	5.79	4.40
E		1.15	1.32	0.99	3.13	4.94	0.33	11.88	6.69
SE		1.81	0.16	0.00	0.16	0.00	0.00	2.16	1.49
S		1.15	1.81	0.82	0.00	0.00	0.00	3.81	2.28
SW		1.32	7.08	32.13	7.08	0.49	0.16	48.29	4.20
W		0.99	1.32	7.08	10.38	3.79	3.62	27.20	6.51
NW		0.00	0.66	0.00	0.00	0.00	0.00	0.68	2.28
CALM	0.16								
Total	0.16	6.59	13.34	44.32	22.24	9.23	4.12	100	

Table 3-9 Nuiqsut Temperature Climate Summary, 2006 Annual Data Summary

2-Meter Temperature (°C)									
Month	Mean			Extreme					
	Maximum Daily (Monthly Average)	Minimum Daily (Monthly Average)	Monthly	Record Highest (Hourly Average)	Year	Day	Record Lowest (Hourly Average)	Year	Day
April 2006	-10.7	-30.6	-20.5	2.5	2002	26	-35.8	2004	2, 3
May 2006	3.6	-15.9	-3.6	18.5	2002	24	-28.7	2001	1
June 2006	18.4	-2.9	8.3	27.3	2003	29	-5.0	2000	5
July 2006	18.1	1.5	9.3	28.0	2001	16	-1.6	2002	26
August 2006	13.9	0.5	4.4	27.8	1999	5	-3.3	2000	27
September 2006	11.6	-0.4	4.0	18.8	2002	5	-13.6	1999	30
October 2006	5.1	-10.9	-3.9	7.4	2003	2	-27.2	1999/ 2004	31/31
November 2006	-4.2	-30.3	-18.7	0.7	2003	6	-35.5	1999	5
December 2006	-2.5	-37.6	-20.1	-2.5	2001/ 2006	28/2	-42.1	1999	18
January 2007	-16.9	-41.1	-27.8	0.6	2005	8	-43.1	2002	23
February 2007	-8.9	-42.3	-26.4	1.8	2006	16	-45.9	2004	19
March 2007	-12.0	-40.3	-29.9	-3.1	2004	21	-40.3	2006/ 2007	11/11
2nd Qtr. 2006	3.8	-16.5	-5.3	-	-	-	-	-	-
3rd Qtr. 2006	14.6	0.5	5.9	-	-	-	-	-	-
4th Qtr. 2006	-0.5	-26.2	-14.2	-	-	-	-	-	-
1st Qtr. 2007	-12.7	-41.2	-28.1	-	-	-	-	-	-
Monitoring Year	1.3	-20.7	-10.3	28.0	2001	16	-45.9	2004	19

Figure 3-10 compares average hourly temperatures by month measured at Nuiqsut during the current monitoring year to historical data collected at Barrow and the Nuiqsut Station. Comparisons are made to Barrow data because that data, collected over a 49-year period, is less likely influenced by interannual variability.

It is typical to see Nuiqsut Station temperatures consistently higher than those collected at Barrow from June through September and equal to those measured at Barrow from October through May. Differences typically observed during the summer are in part related to the fact that the Nuiqsut Station is located further inland than Barrow and away from moderating effects of the ocean.

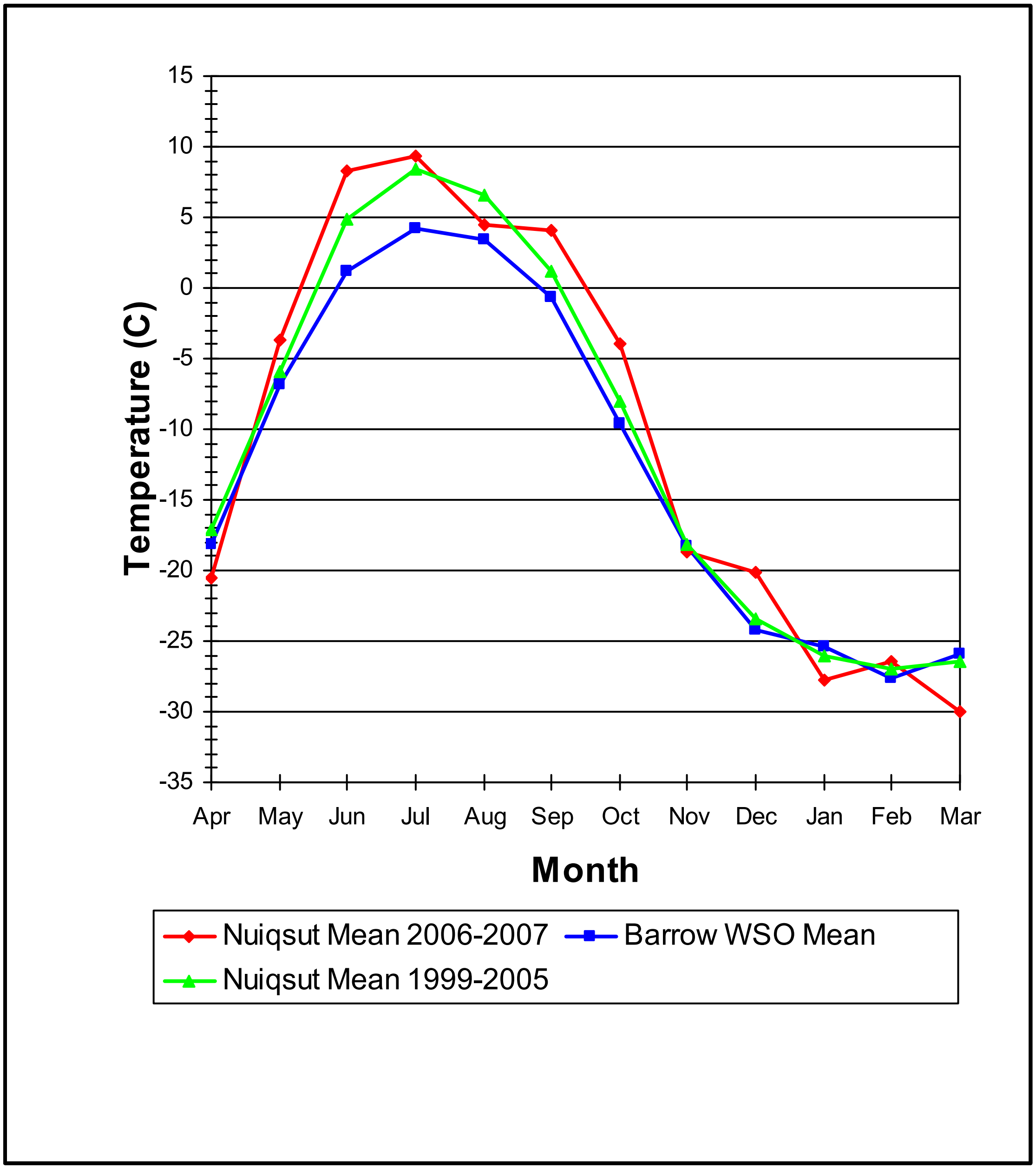


Figure 3-10 Nuiqsut Station Temperature Climatology, 2006 Annual Data Summary

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