FINAL

NUIQSUT AMBIENT AIR QUALITY MONITORING PROGRAM
2005 MONITORING YEAR DATA SUMMARY
APRIL 1, 2005 THROUGH MARCH 31, 2006

FOR

CONOCOPHILLIPS ALASKA, INC.

Alpine Central Processing Facility

August 2006
12CP.11481.05.0045

Prepared by:

SECOR International Incorporated - Air Quality Division
Thomas A. Damiana
Air Quality Meteorologist/Engineer
tdamiana@secor.com
970 226 4040 extension 721

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EXECUTIVE SUMMARY

This report summarizes data collected at the Nuiqsut Ambient Air Quality Monitoring Station (Nuiqsut Station) during the 2005 monitoring year (April 2005 through March 2006). 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) one 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 is also 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 (NO_x, SO_2, PM_{10}, and 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 with the exception that the second quarter air quality measurement system and first 2005 semiannual meteorological measurement system calibrations were delayed; therefore, not conducted above the minimum frequency suggested in the QAPP. Though the calibrations were delayed, enough documentation exists to confirm measurement systems were reporting measurements to within specified limits and data quality should not be questioned.

As shown in Table 1, air quality and meteorological quarterly data capture exceeded QAPP goals for all parameters except vertical wind speed, vertical wind speed standard deviation, 2 meter temperature, 10 meter temperature, 2-10 meter temperature lapse and NO_x data.

Tables 2 through 5 summarize average 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. Two measured daily PM_{10} concentrations exceeded the AAAQS as a result of naturally occurring events.

The annual average of hourly NO_2 concentrations was just above instrument detection, and well below applicable AAAQS. Concentrations measured this monitoring year were generally lower than historical measurements. Contrary to historical trends (i.e., measured NO_2 concentrations higher in summer and lower in winter), NO_2 measurements this year showed little seasonal variation.

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 higher compared to previous years. This was the result of many periods throughout the summer when wind blown fugitive dust from the Nechelik Channel banks caused elevated daily measurements. Two of those daily measurements were high enough to exceeded the AAAQS. Though considerably elevated this year, measurements were consistent with the historical observation that all elevated particulate concentrations measured result from naturally occurring wind blown fugitive dust from exposed areas local to the Nuiqsut Station. When fugitive dust from exposed areas is not present (i.e., during winter), hourly concentrations are at or below the instrument detection limit 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 homogenous and representative of a regional background.

TABLE 1

MONITORING YEAR DATA RECOVERY STATISTICS SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	2nd Quarter 2005 (%)	3rd Quarter 2005 (%)	4th Quarter 2005 (%)	1st Quarter 2006 (%)	Required Capture Rates (%)
Meteorological					
10-m Horizontal Wind Speed	95.3	99.7	91.8	91.9	90
10-m Horizontal Sigma-u (σ_u)	95.3	99.7	91.8	91.9	
10-m Horizontal Wind Direction	95.3	99.7	91.8	91.9	
10-m Sigma-Theta (σ_θ)	95.3	99.7	91.8	91.9	
10-m Vertical Wind Speed	**88.3**	99.7	**88.0**	91.5	
10-m Vertical Sigma-w (σ_w)	**88.3**	99.7	**88.0**	91.5	
10-m Temperature	95.6	100	**71.9**	**10.1**	
2-m Temperature	95.6	100	**53.9**	97.2	
10-2m Temperature Lapse	95.6	100	**27.5**	**10.1**	
Total Solar Radiation	95.8	100	98.7	97.2	
Air Quality					
Nitrogen Dioxide (NO_2)	95.1	99.0	**53.7**	**44.1**	80
Sulfur Dioxide (SO_2)	95.1	99.0	97.2	96.4	
Ozone (O_3)	94.5	96.7	93.0	92.3	
Particulate (PM_{10}) (TEOM)	98.4	99.1	95.6	84.6	

TABLE 2

MEASURED NITROGEN DIOXIDE DATA SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Monitoring Period	Year	Period Mean (ppm)	Number of Exceedances
2nd Qtr.	2005	0.001	None
3rd Qtr.	2005	0.001	None
4th Qtr.	2005	0.001	None
1st Qtr.	2006	0.002	None
Annual	2005	0.002	None

NAAQS/AAAQS:

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

TABLE 3

MEASURED SULFUR DIOXIDE DATA SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 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.	2005	0.003	0.003	0.001	0.001	0.000	None
3rd Qtr.	2005	0.001	0.001	0.001	0.001	0.000	None
4th Qtr.	2005	0.002	0.002	0.001	0.001	0.000	None
1st Qtr.	2006	0.002	0.002	0.001	0.001	0.000	None
Annual	2005	0.003	0.003	0.001	0.001	0.000	None

NAAQS/AAAQS:

- 3-hour - 0.5 ppm (1,300 $\mu g/m^3$) – 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.

TABLE 4

MEASURED PM_{10} DATA SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Monitoring Period	Year	24-hour ($\mu g/m^3$)		Period Mean ($\mu g/m^3$)	Number of Exceedances
		1st high	2nd high		
2nd Qtr.	2005	109	44.9	10.2	None
3rd Qtr.	2005	**331**	**292**	22.2	2
4th Qtr.	2005	21.2	16.3	7.5	None
1st Qtr.	2006	23.5	12.7	6.1	None
Annual	2005	**331**	**292**	11.8	2

NAAQS/AAAQS:

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

TABLE 5

MEASURED OZONE DATA SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Monitoring Period	Year	8-hour (ppm)			Period Mean (ppm)	Number of Exceedances
		1st high	2nd high	4th high		
2nd Qtr.	2005	0.049	0.049	0.048	0.018	None
3rd Qtr.	2005	0.042	0.042	0.040	0.016	None
4th Qtr.	2005	0.028	0.028	0.028	0.020	None
1st Qtr.	2006	0.041	0.041	0.041	0.022	None
Annual	2005	0.049	0.049	0.048	0.019	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.

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 is primarily designed to characterize ambient air in Nuiqsut as regional oilfield development continues. This Monitoring Program has been administered according to 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 is also 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) 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 the Fall 2002.
- Enhanced dispersion meteorology characterization through the addition of 10 meter temperature, vertical wind speed and solar radiation monitoring (July 24, 2001).
- Expanded background air quality evaluation through the addition of ozone 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 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), final ADEC approval pending;
- 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

There were no procedures used during the monitoring year that differed from those specified in the QAPP. In general, QAPP data capture rate and QA goals were met for all parameters except as follows:

- Quarterly data capture rate goals for vertical wind speed, 2 meter temperature, 10 meter temperature, 2-10 meter temperature lapse and NO_x data were not met for portions of the monitoring year.
- The second quarter air quality measurement system and first 2005 semiannual meteorological measurement system calibrations were delayed; therefore, not conducted above the minimum frequency suggested in the QAPP. Though the calibrations were delayed, enough documentation exists to confirm systems were reporting measurements to within specified limits and data quality should not be questioned.

These deviations from the QAPP are fully documented in Sections 2.3 and 2.4.

TABLE 1-1

MEASUREMENT METHODS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	Suggested Manufacturer/Model	Sample Frequency	Averaging Period	Measurement Range	Lower Detection Limit	Method
Nitrogen Oxides (NO_x, NO_2, NO)	Thermo Environmental Instruments (TECO) Model 42C	Continuous	1-hour	1-500 ppb	0.5 ppb	Chemiluminescence (EPA 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 (EPA equivalent method EQSA-0486-060)
Particulate Matter (PM_{10})	Rupprecht & Patashnick (R&P) Model 1400ab TEOM PM_{10}	Continuous	1-hour	<5 $\mu g/m^3$ to several g/m^3	<5 $\mu g/m^3$	Tapered Element Oscillating Microbalance (EPA equivalent method EQPM-1090-079)
Ozone (O_3)	Thermo Environmental Model 49	Continuous	1-hour	0-1,000 ppb	2 ppb	Pulsed UV Photometric (EPA equivalent method EQOA-0880-047)
Horizontal Wind Speed (u) (10 m)	R.M. Young Wind Monitor AQ – 05305	Continuous	1-hour	0 to 50 m/s	0.4 m/s	Propeller/Magnetically Induced AC
Sigma-u (σ_u) (10 m)	Campbell Scientific Model 23X	Continuous	1-hour	0 to 50 m/s	N.A.	Standard Deviation
Horizontal Wind Direction (θ) (10 m)	R.M. Young Wind Monitor AQ – 05305	Continuous	1-hour	0 to 360°	N.A.	Vane/Potentiometer
Sigma-Theta (σ_θ) (10 m)	Campbell Scientific Model 23X	Continuous	1-hour	0 to 103.9°	N.A.	Single Pass Estimator of Wind Direction Standard Deviation (Yamartino 1984)

TABLE 1-1 (CONTINUED)

MEASUREMENT METHODS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	Manufacturer/Model	Sample Frequency	Averaging Period	Measurement Range	Lower Detection Limit	Method
Temperature (2 m)	YSI 44020	Continuous	1-hour	-50°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
Total Solar Radiation (2 m)	Eppley 8-48	Continuous	1-hour	0 to 1,400 W/m^2	<1 W/m^2	Differential Thermopile

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.

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 sub-sections 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.

2.2.1 NO_x, SO_2 and O_3 Data

Second Quarter 2005
Quarterly NO_x, SO_2 and O_3 data losses were limited to an unexplained data logger memory purge followed by a communication error, a poorly connected O_3 instrument signal wire, and power failures.

Third Quarter 2005
Quarterly O_3 data losses occurred due to a poorly connected instrument signal wire and incomplete sample line purging following automatic nightly Level I calibration checks. There were no significant NO_x and SO_2 data losses this quarter.

Fourth Quarter 2005
Quarterly NO_x data losses occurred for two separate periods when the instrument was off-line. The instrument was off-line the first time as a result of a seized sample pump and blown fuse. This situation was corrected only the have the fuse blow again three weeks later. During a subsequent attempt to repair the blown fuse, the on-site technician permanently disabled the instrument. The instrument was replaced and brought back online during the first quarter 2006. Quarterly O_3 data losses occurred due to a poorly connected instrument signal wire and incomplete sample line purging following automatic nightly Level I calibration checks. There were no significant SO_2 data losses this quarter.

First Quarter 2006
Quarterly NO_x data losses occurred because the instrument was off-line due to a failed repair activity that occurred during the fourth quarter 2005. A replacement instrument was shipped to the station and installed. On February 17, 2006 a multipoint calibration was conducted and the

TABLE 2-1

SIGNIFICANT PROJECT EVENTS
CONOCOPHILLIPS ALASKA, INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Date	Event/Comment
April 1 through April 4, 2005	All data lost as a result of an unexplained data logger memory purge and communication error. Poor telecommunications prevented remote access to logged data. When access was established, the data in question could not be retrieved from the data logger memory.
May 24 and May 25, 2005	Second quarter independent performance audit of the air quality and meteorological measurement systems conducted by AMSTech. Except for horizontal wind speed, the audit confirmed all air quality and meteorological systems were reporting measurements to within acceptable limits.
May 28 and May 29, 2005	Several hours of O_3 data lost when an intermittent electrical short caused by a poorly connected signal wire over-ranged the data logger. The problem was discovered and corrected by the on-site technician.
August 23 through August 25, 2005	Second quarter calibration of the air quality measurement systems conducted by SECOR. The calibration and routine site maintenance visit confirmed all air quality systems were reporting measurements to within acceptable limits. Horizontal wind speed/direction sensor was replaced and calibrated because previous QA activities indicated wind speed sensor wiring was compromised.
August 27, 2005 through March 31, 2006	Several hourly O_3 measurements were contaminated with span gas in the hour during and following the nightly Level I calibration check and invalidated.
September 13 and September 14, 2005	Second quarter independent performance audit of the air quality measurement systems conducted by AMSTech. The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
September 14 through September 31, 2005	Several hourly O_3 measurements were lost when an intermittent electrical short caused by a poorly connected signal wire over-ranged the data logger. The problem was corrected by SECOR during a site visit.
October 9 through October 11, 2005	Several hours of PM_{10} data were invalidated due to instrument signal noise outside acceptable limits. Elevated signal noise resulted from extremely high winds vibrating the instrument.
October 25 through October 27, 2005	Third quarter calibration of the air quality and meteorological measurement systems conducted by SECOR. The calibration and routine site maintenance visit confirmed all air quality and meteorological systems were reporting measurements to within acceptable limits.

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TABLE 2-1 (CONTINUED)

SIGNIFICANT PROJECT EVENTS
CONOCOPHILLIPS ALASKA, INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Date	Event/Comment
October 27, 2005 though March 22, 2006	Following the third quarter calibration, the 2 meter temperature sensor dropped off-line due to aged wiring. The sensor remained off-line until December 7 when the 2 meter sensor was replaced with the working 10 meter temperature sensor. Following the exchange, 10 meter temperature data was unavailable. Since only one temperature measurement level was online at any given time, no temperature lapse measurements were available. The 10 meter sensor was replaced during the first quarter 2006 calibration.
November 1 through December 6, 2005	The NO_x instrument was off-line as a result of a seized sample pump and blown fuse. Repairs were made to the instrument during the fourth quarter calibration.
December 6 through December 8, 2005	Fourth quarter calibration of the air quality measurement systems conducted by SECOR. The calibration and routine site maintenance visit confirmed all air quality systems were reporting measurements to within acceptable limits. Fourth quarter independent performance audit of the air quality and meteorological measurement systems conducted by AMSTech. The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
December 25, 2005 though February 17, 2006	The NO_x instrument was off-line as a result of a blown fuse. During a subsequent attempt to repair the blown fuse, the on-site technician permanently disabled the instrument. A replacement instrument was shipped to the station and on February 17, 2006 a multipoint calibration was conducted and the NO_x-NO-NO_2 measurement system was brought online.
February 14 through March 11, 2006	Several hours of PM_{10} data were invalidated due to instrument signal noise outside acceptable limits. Elevated signal noise resulted from extremely high winds vibrating the instrument.
March 20 through March 22, 2006	First quarter calibration of the air quality and meteorological measurement systems conducted by SECOR. The calibration and routine site maintenance visit confirmed all air quality and meteorological systems were reporting measurements to within acceptable limits. Fourth quarter independent performance audit of the air quality measurement systems conducted by AMSTech. The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
March 22 through March 26, 2006	PM_{10} data was unavailable due to a communications error.

NO_x-NO-NO_2 measurement system was brought online. Quarterly O_3 data losses occurred due to a poorly connected instrument signal wire and incomplete sample line purging following automatic nightly Level I calibration checks. There were no significant SO_2 data loses this quarter.

2.2.2 PM_{10} Data

During the monitoring year, losses of PM_{10} data were generally limited to power failures, routine on-site maintenance, calibration, and auditing activities. Several hours of PM_{10} data in October, March and February were invalidated due to instrument signal noise outside acceptable limits. Elevated signal noise resulted from extremely high winds (>12 m/s) vibrating the instrument. Four days of PM_{10} data was unavailable due to a communications error the last week of March 2006.

2.2.3 Meteorological Data

During the monitoring year, nonroutine losses of horizontal wind speed/direction and vertical wind speed data occurred due to frozen sensors.

A significant loss of temperature data occurred from October 27, 2005 through March 22, 2006 after the 2 meter temperature sensor dropped off-line due to aged wiring. The sensor remained off-line until December 7 when the 2 meter temperature sensor was replaced with the working 10 meter temperature sensor. Following the exchange, 10 meter temperature data was unavailable until a new sensor was installed and calibrated on March 20, 2006. Since only one temperature measurement level was online at any given time, no temperature lapse measurements were available.

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. Network data capture rates for the year achieved QAPP goals for all parameters except vertical wind speed related measurements, 2 meter temperature, 10 meter temperature, 10-2 meter temperature lapse, and NO_x measurements.

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

- vertical wind speed data loses were primarily the result of a snow loaded and/or frozen sensor.
- temperature data loses were the result of one of the two station temperature probes being off-line due to aged wiring, and
- NO_x data loses were the result of the instrument being off-line on two occasions; once due to a blown fuse and once due to a disabled instrument.

TABLE 2-2

MONITORING YEAR DATA RECOVERY STATISTICS SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	2nd Quarter 2005 (%)	3rd Quarter 2005 (%)	4th Quarter 2005 (%)	1st Quarter 2006 (%)	Required Capture Rates (%)
Meteorological					
10-m Horizontal Wind Speed	95.3	99.7	91.8	91.9	90
10-m Horizontal Sigma-u (σ_u)	95.3	99.7	91.8	91.9	
10-m Horizontal Wind Direction	95.3	99.7	91.8	91.9	
10-m Sigma-Theta (σ_θ)	95.3	99.7	91.8	91.9	
10-m Vertical Wind Speed	**88.3**	99.7	**88.0**	91.5	
10-m Vertical Sigma-w (σ_w)	**88.3**	99.7	**88.0**	91.5	
10-m Temperature	95.6	100	**71.9**	**10.1**	
2-m Temperature	95.6	100	**53.9**	97.2	
10-2m Temperature Lapse	95.6	100	**27.5**	**10.1**	
Total Solar Radiation	95.8	100	98.7	97.2	
Air Quality					
Nitrogen Dioxide (NO_2)	95.1	99.0	**53.7**	**44.1**	80
Sulfur Dioxide (SO_2)	95.1	99.0	97.2	96.4	
Ozone (O_3)	94.5	96.7	93.0	92.3	
Particulate (PM_{10}) (TEOM)	98.4	99.1	95.6	84.6	

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 2-3a through 2-3d 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.

2.5 Accuracy Statistics

Meteorological and ambient air quality measurement systems are subjected to periodic calibrations/Quality Control (QC) checks and independent QA performance audits to document measurement system accuracy. All calibration/QC check and audit equipment is traceable to authoritative 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 2-4a through Table 2-4d 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.

Second Quarter 2005

The second quarter calibration of the air quality measurement systems was conducted by SECOR August 23 through 25, 2005 approximately two months behind schedule. Ramifications of this deviation from QAPP goals are discussed at the end of this section. Results of this QA activity are summarized in Table 2-4a which shows all air quality systems were reporting measurements to within acceptable limits.

Due to the amount of time involved in rebuilding and calibrating the horizontal wind speed/direction measurement system, the semiannual calibration of the temperature, vertical wind speed and solar radiation measurement systems was delayed until the third quarter calibration conducted October 25 through 27, 2005. Ramifications of this deviation from QAPP goals are discussed at the end of this section. Results of the wind speed/direction calibration are summarized in Table 2-4a which shows this system was reporting measurements to within acceptable limits.

Tests were conducted on the horizontal wind speed sensor during the second quarter QA activity to corroborate the results of the second quarter audit. The audit results indicated

TABLE 2-3A

SECOND QUARTER 2005 PRECISION STATISTICS SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	Number of Precision Checks (N)	Average Percent Difference $\left(\bar{d}j\right)$	Standard Deviation (S_j)	Upper 95% Probability Limit (U_{95})	Lower 95% Probability Limit (L_{95})
NO	13	0.79	2.1	5.0	-3.4
NO_2	11	-0.30	5.4	10	-11
SO_2	13	2.6	3.9	10	-5.0
O_3	12	-0.30	6.0	12	-12
Precision Goal	N.A.	±15	N.A.	15	-15

Remarks:

NO_x Precision Statistics: Two NO_2 precision checks were not conducted the beginning of April due to a slow response of the automated weekly NO_2 precision check system following the first quarter calibration which was conduced in late March 2005. The system response improved by mid-April and subsequent precision checks showed the instrument operating within acceptable limits. Data quality should not be questioned since NO_2 precision checks conducted before and after the system was malfunctioning showed the instrument reporting measurements to within acceptable limits. Furthermore, all NO and NO_x precision checks and nightly Level I calibration checks showed the instrument was stable when NO_2 precision results were not available.

O_3 Precision Statistics: One weekly precision check was not executed properly in mid-May. Since at least one precision check was conducted at least every two-weeks, QAPP goals were met and data quality should not be questioned.

Note: This table summarizes data presented in Appendix B, Table B-1.

TABLE 2-3B

THIRD QUARTER 2005 PRECISION STATISTICS SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA 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	15	1.7	0.80	3.3	0.13
NO_2	15	-0.27	1.5	2.7	-3.3
SO_2	15	2.8	4.0	11	-5.1
O_3	11	-2.2	7.9	13	-18
Precision Goal	N.A.	±15	N.A.	15	-15

Remarks:
O_3 Precision Statistics: For most of the quarter, the station automatic calibration system only produced O_3 precision checks at 6% of full scale. Therefore precision statistics were based on the comparison of small values which lead to a lot of variation in the calculated percent difference, a high standard deviation and high upper and lower probability limits. Four O_3 precision checks were conducted at levels below 6% full scale and not included in this summary because the calculated precision metrics were not meaningful. Though precision statistics could not be generated at the proper input concentration, low level and span level concentration precision data was available and indicated measurements were being reported within acceptable limits. Therefore, data quality should not be questioned during the two periods precision checks were unavailable.

Note: This table summarizes data presented in Appendix B, Table B-2.

TABLE 2-3C

FOURTH QUARTER 2005 PRECISION STATISTICS SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA 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	7	4.1	2.8	9.6	-1.4
NO_2	7	2.2	2.5	7.2	-2.8
SO_2	13	5.8	2.4	11	1.0
O_3	13	-1.0	5.4	9.6	-11.6
Precision Goal	N.A.	±15	N.A.	15	-15

Remarks:

NO_x Precision Statistics: The NO_x instrument was off-line approximately half the quarter leading to the low number of precision checks.

SO_2 Precision Statistics: Two weekly precision checks were not executed properly during the quarter. Since at least one precision check was conducted at least every two weeks, QAPP goals were met and data quality should not be questioned.

O_3 Precision Statistics: For most of the quarter, the station automatic calibration system only produced O_3 precision checks at 6% of full scale. Therefore, precision statistics were based on the comparison of small values which lead to a lot of variation in the calculated percent difference, a high standard deviation and high upper and lower probability limits.

Note: This table summarizes data presented in Appendix B, Table B-3.

TABLE 2-3D

FIRST QUARTER 2006 PRECISION STATISTICS SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA 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	7	3.2	3.9	11	-4.5
NO_2	7	0.0	0.77	1.5	-1.5
SO_2	14	5.1	4.7	14	-4.1
O_3	12	-1.7	4.8	7.8	-11
Precision Goal	N.A.	±15	N.A.	15	-15

Remarks:
NO_x Precision Statistics: The NO_x instrument was off-line approximately half the quarter leading to the low number of precision checks.

O_3 Precision Statistics: For most of the quarter, the station automatic calibration system only produced O_3 precision checks at 6% of full scale. Therefore, precision statistics were based on the comparison of small values which lead to a lot of variation in the calculated percent difference, a high standard deviation and high upper and lower probability limits. Two checks were not executed properly and not included in the statistics. Since at least one precision check was conducted at least every two weeks, QAPP goals were met and data quality should not be questioned.

Note: This table summarizes data presented in Appendix B, Table B-4.

TABLE 2-4A

SECOND QUARTER 2005 CALIBRATION RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Calibration August 23 through 25, 2005					
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	0.78%	Pass	
	Correlation Coef.	≥ 0.9950	0.94	Pass	
NO_x	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	2.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	1.9%	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	0.48%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	-2.4%	Pass	
	Total Flow	≤ ±10%	-6.0%	Pass	
	Mass Determination	≤ ±2.5%	0.45%	Pass	

TABLE 2-4A (CONTINUED)

SECOND QUARTER 2005 CALIBRATION RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Meteorological Calibration August 23 through 25, 2005					
10-m Horizontal Wind Speed	Accuracy	≤ ±5%	0.0%	Pass	The calibration confirmed the wind speed and wind direction systems were reporting measurements to within acceptable limits. A full calibration was scheduled for this QA activity but could not be completed due to lack of time. The full semiannual calibration was instead completed during the third calendar quarter.
	Starting Torque	≤ 1 g-cm	0.3 g-cm	Pass	
10-m Horizontal Wind Direction	Accuracy	≤ ±5 deg.	-0.5 deg.	Pass	
	Linearity	≤ ±3 deg.	0.0 deg.	Pass	
	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 2-4B

THIRD QUARTER 2005 CALIBRATION RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Calibration October 25 through 27, 2005					
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	0.99	Pass	
	Intercept	≤ ±3% full scale	1.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	0.76%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	104%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	0.03%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
PM_{10}	Sample Flow	≤ ±10%	-0.7%	Pass	
	Total Flow	≤ ±10%	-3.0%	Pass	
	Mass Determination	≤ ±2.5%	0.54%	Pass	

TABLE 2-4B (CONTINUED)

THIRD QUARTER 2005 CALIBRATION RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Meteorological Calibration August 23 through 25, 2005					
10-m Horizontal Wind Speed	Accuracy	≤ ±5%	0.0%	Pass	The calibration confirmed all meteorological systems were reporting measurements to within acceptable limits. A solar radiation calibration could not be conducted due to low sun angles and cloud covered conditions during this time of year.
	Starting Torque	≤ 1 g-cm	0.5 g-cm	Pass	
10-m Horizontal Wind Direction	Accuracy	≤ ±5 deg.	1.1 deg.	Pass	
	Linearity	≤ ±3 deg.	-0.013 deg.	Pass	
	Starting Torque	≤ 11.0 g-cm	3.0 g-cm	Pass	
10-m Vertical Wind Speed	Accuracy	≤ ±2.5 m/s	0.040 m/s	Pass	
	Starting Torque	≤ 1 g-cm	-0.3 g-cm	Pass	
10-m Temperature	Accuracy	≤ ±0.5 °C	-0.20 °C	Pass	
2-m Temperature	Accuracy	≤ ±0.5 °C	-0.20 °C	Pass	
10-2m Temperature Lapse	Accuracy	≤ ±0.1 °C	0.0 °C	Pass	
Total Solar Radiation	Accuracy	≤ ±25 W/m^2	-	N.A.	

TABLE 2-4C

FOURTH QUARTER 2005 CALIBRATION RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Calibration December 6 through 8, 2005					
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	0.94%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO_x	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	1.09%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	1.44%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO_2	Converter Eff.	≥ 96%	101%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	1.00	Pass	
	Intercept	≤ ±3% full scale	0.07%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
PM_{10}	Sample Flow	≤ ±10%	0.0%	Pass	
	Total Flow	≤ ±10%	-5.0%	Pass	
	Mass Determination	≤ ±2.5%	1.59%	Pass	
Meteorological Calibration					
Conducting a calibration of meteorological measurement systems is only required semiannually and was conducted during the third calendar quarter 2005 and first calendar quarter of 2006.					

TABLE 2-4D

FIRST QUARTER 2006 CALIBRATION RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Calibration March 20 through 22, 2006					
SO_2	Slope	≥ 0.85 and ≤ 1.15	1.01	Pass	The calibration confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	0.58%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO_x	Slope	≥ 0.85 and ≤ 1.15	1.02	Pass	
	Intercept	≤ ±3% full scale	0.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	1.01	Pass	
	Intercept	≤ ±3% full scale	0.13%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
NO_2	Converter Eff.	≥ 96%	104%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	0.37%	Pass	
	Correlation Coef.	≥ 0.9950	1.00	Pass	
PM_{10}	Sample Flow	≤ ±10%	0.3%	Pass	
	Total Flow	≤ ±10%	-0.6%	Pass	
	Mass Determination	≤ ±2.5%	0.50%	Pass	

TABLE 2-4D (CONTINUED)

FIRST QUARTER 2006 CALIBRATION RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Meteorological Calibration March 20 through 22, 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	0.8 g-cm	Pass	
10-m Horizontal Wind Direction	Accuracy	≤ ±5 deg.	0.025 deg.	Pass	
	Linearity	≤ ±3 deg.	0.01 deg.	Pass	
	Starting Torque	≤ 11.0 g-cm	6.0 g-cm	Pass	
10-m Vertical Wind Speed	Accuracy	≤ ±2.5 m/s	0.027 m/s	Pass	
	Starting Torque	≤ 1 g-cm	0.8 g-cm	Pass	
10-m Temperature	Accuracy	≤ ±0.5 °C	0.10 °C	Pass	
2-m Temperature	Accuracy	≤ ±0.5 °C	0.025 °C	Pass	
10-2m Temperature Lapse	Accuracy	≤ ±0.1 °C	0.0 °C	Pass	
Total Solar Radiation	Accuracy	≤ ±25 W/m^2	4.3 W/m^2	Pass	

horizontal wind speed measurements had a systematic bias suggesting the presence of a source of background electrical noise in the measurement system. Though the checks conducted by SECOR indicated some background noise was present in the measurement system, the noise was not sufficient to cause measurement accuracy errors outside acceptable limits. Furthermore, a statistical review of data collected between the previous system QA activity (i.e., the semiannual calibration conducted by SECOR on November 16, 2004) the audit and post-audit QA activity (i.e., the third quarter calibration conducted by SECOR August 23 through 25, 2005) could find no evidence supporting any system bias prior to or after the audit. It is hypothesized that when the wind speed sensor was brought to the ground for audit checks, aging system wiring was compromised resulting in the reported bias. When the sensor was returned to the tower, the original wiring configuration was restored and the bias disappeared. Since the subsequent calibration was conducted with the sensor in place on the tower (i.e., without disturbing system wiring), no significant bias was detected. Still, measurement system integrity was suspect; therefore, the wind speed/direction sensor and system wiring was replaced during the quarterly calibration. Since it has been concluded the failed audit resulted from auditing procedures, no horizontal wind speed data has been corrected or invalidated as a result of audit findings.

Third Quarter 2005

The third quarter calibration of the air quality measurement systems was conducted by SECOR on October 25 through 27, 2005. Though it was not conducted within the third calendar quarter, it was conducted within three months of the previous system calibration in accordance with QAPP goals. Results of this QA activity are summarized in Table 2-4b which shows all air quality systems were reporting measurements to within acceptable limits.

The meteorological measurement system semiannual calibration was conducted on October 25, 2006 approximately 11 months after the previous system calibration. QAPP goals target a meteorological measurement system calibration every 6 months. Ramifications of this deviation from QAPP goals are discussed at the end of this section. Results of this QA activity are summarized in Table 2-4b which shows all meteorological systems were reporting measurements to within acceptable limits.

Fourth Quarter 2005

The fourth quarter air quality measurement system calibration was conducted by SECOR from December 6 through 8, 2005. Results of this QA activity are summarized in Table 2-4c, which shows all air quality systems were reporting measurements to within acceptable limits.

First Quarter 2006

The first quarter air quality and meteorological measurement system calibration was conducted by SECOR from March 20 through 22, 2006. Results of this QA activity are summarized in Table 2-4d, which shows all air quality and meteorological systems were reporting measurements to within acceptable limits.

Deviations from the QAPP

Due to delayed calibrations, QAPP goals were not met for the following four period/parameter combinations:

- **Air quality** data collection QA goals were not met from March 23 through (first quarter 2005 calibration) August 24, 2005 (delayed second quarter 2005 calibration) because more than three months elapsed between quarterly calibrations. Regardless, system data accuracy should not be questioned because the period is bracketed by calibrations demonstrating the system was reporting measurements to within acceptable limits and the system was stable during the period as demonstrated by the results of the following QA activities:
    - 155 Nightly Level I Calibration Checks,
    - 17 Weekly Precision Checks, and
    - 1 Independent Performance Audit (Conducted May 24 and 25, 2005)

- **Horizontal wind direction** data collection QA goals were not met from November 16, 2004 (second 2004 semiannual calibration) through August 24, 2005 (sensor replacement and calibration) because more than six months elapsed between system calibrations. Regardless, data accuracy should not be questioned because bracketing calibrations combined with historical evidence of high system accuracy stability and the results of the semiannual audit conducted in May 2006 proves this sensor continually reported measurements to within acceptable limits.

- **Horizontal wind speed** data collection QA goals were not met from November 16, 2004 (second 2004 semiannual calibration) through August 24, 2005 (sensor replacement and calibration) because more than six months elapsed between system calibrations. Regardless, data accuracy should not be questioned because bracketing calibrations combined with historical evidence of high system accuracy stability proves this sensor continually reported measurements to within acceptable limits. As detailed in the Quarter #2 Data Summary Report, the results of the semiannual audit conducted in May 2006 were considered erroneous for this sensor and cannot be used to help establish sensor accuracy.

- **Temperature, vertical wind speed and solar radiation** data collection QA goals were not met from November 16, 2004 (second 2004 semiannual calibration) through October 25, 2005 (delayed first 2005 semiannual calibration) because more than six months elapsed between system calibrations. Regardless, data accuracy should not be questioned because bracketing calibrations combined with historical evidence of high system accuracy stability and the results of the semiannual audit conducted in May 2006 proves these sensors continually reported measurements to within acceptable limits.

2.5.2 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 2-5a through Table 2-5d for each measurement parameter.

TABLE 2-5A

SECOND QUARTER 2005 AUDIT RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Audit May 24 though 25, 2005					
SO_2	Slope	≥ 0.85 and ≤ 1.15	0.97	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	1.1	Pass	
	Intercept	≤ ±3% full scale	0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	1.1	Pass	
	Intercept	≤ ±3% full scale	-0.4%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	99.4%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	1.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	-4.7%	Pass	
	Total Flow	≤ ±10%	0.48%	Pass	
	Mass Determination	≤ ±2.5%	1.0%	Pass	

TABLE 2-5A (CONTINUED)

SECOND QUARTER 2005 AUDIT RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Meteorological Audit May 24 though 25, 2005					
10-m Horizontal Wind Speed	Accuracy	≤ ±5%	**6.1%**	**Fail**	The audit confirmed all meteorological systems except for the horizontal wind speed 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.	1.5 deg.	Pass	
	Linearity	≤ ±3 deg.	0.9 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	0.15 °C	Pass	
2-m Temperature	Accuracy	≤ ±0.5 °C	0.17 °C	Pass	
10-2m Temperature Lapse	Accuracy	≤ ±0.1 °C	0.02 °C	Pass	
Total Solar Radiation	Accuracy	≤ ±5% full scale	2.2%	Pass	

TABLE 2-5B

THIRD QUARTER 2005 AUDIT RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Audit September 13 through 14, 2005					
SO_2	Slope	≥ 0.85 and ≤ 1.15	0.95	Pass	The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	0.20%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_x	Slope	≥ 0.85 and ≤ 1.15	0.99	Pass	
	Intercept	≤ ±3% full scale	-0.20%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	-0.20%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	100%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	1.01	Pass	
	Intercept	≤ ±3% full scale	1.4%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	-1.6%	Pass	
	Total Flow	≤ ±10%	-2.0%	Pass	
	Mass Determination	≤ ±2.5%	1.06%	Pass	
Meteorological Calibration					
Conducting a meteorological measurement systems audit is only required semiannually and was conducted during the second and fourth calendar quarters of 2005.					

TABLE 2-5C

FOURTH QUARTER 2005 AUDIT RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Audit December 6 through 8, 2005					
SO_2	Slope	≥ 0.85 and ≤ 1.15	0.87	Pass	The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	0.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_x	Slope	≥ 0.85 and ≤ 1.15	0.87	Pass	
	Intercept	≤ ±3% full scale	0.6%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	0.87	Pass	
	Intercept	≤ ±3% full scale	0.4%	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	-1.2%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	2.0%	Pass	
	Total Flow	≤ ±10%	-7.1%	Pass	
	Mass Determination	≤ ±2.5%	0.92%	Pass	

TABLE 2-5C (CONTINUED)

FOURTH QUARTER 2005 AUDIT RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Meteorological Audit December 6 through 8, 2005					
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. The 2-meter temperature sensor was off-line; therefore, a 2-meter temperature and corresponding temperature lapse audit could not be conducted. A solar radiation audit could not be conducted due to low sun angles during this time of year.
	Starting Torque	≤ 1 g-cm	0.3 g-cm	Pass	
10-m Horizontal Wind Direction	Accuracy	≤ ±5 deg.	1.3 deg.	Pass	
	Linearity	≤ ±3 deg.	0.6 deg.	Pass	
	Starting Torque	≤ 11.0 g-cm	6.0 g-cm	Pass	
10-m Vertical Wind Speed	Accuracy	≤ ±2.5 m/s	0.78 m/s	Pass	
	Starting Torque	≤ 1 g-cm	0.4 g-cm	Pass	
10-m Temperature	Accuracy	≤ ±0.5 °C	0.24 °C	Pass	
2-m Temperature	Accuracy	≤ ±0.5 °C	-	N.A.	
10-2m Temperature Lapse	Accuracy	≤ ±0.1 °C	-	N.A.	
Total Solar Radiation	Accuracy	≤ ±5% full scale	-	N.A.	

TABLE 2-5D

FIRST QUARTER 2006 AUDIT RESULTS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Parameter	QC Check Category	QC Check Criteria	Measured Response	Results (Pass/Fail)	Comments
Air Quality Audit March 22, 2006					
SO_2	Slope	≥ 0.85 and ≤ 1.15	0.88	Pass	The audit confirmed all air quality systems were reporting measurements to within acceptable limits.
	Intercept	≤ ±3% full scale	0.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_x	Slope	≥ 0.85 and ≤ 1.15	0.91	Pass	
	Intercept	≤ ±3% full scale	0.20%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO	Slope	≥ 0.85 and ≤ 1.15	0.90	Pass	
	Intercept	≤ ±3% full scale	0.0%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
NO_2	Converter Eff.	≥ 96%	99.8%	Pass	
O_3	Slope	≥ 0.85 and ≤ 1.15	1.0	Pass	
	Intercept	≤ ±3% full scale	0.60%	Pass	
	Correlation Coef.	≥ 0.9950	1.0	Pass	
PM_{10}	Sample Flow	≤ ±10%	1.7%	Pass	
	Total Flow	≤ ±10%	-2.9%	Pass	
	Mass Determination	≤ ±2.5%	1.0%	Pass	
Meteorological Audit					
Conducting meteorological measurement systems audit is only required semiannually and was conducted during the fourth 2005 and second calendar quarter of 2006.					

Second Quarter 2005
The second quarter 2005 air quality and meteorological measurement system performance audit was conducted by Air Monitoring Services and Technology (AMSTech) May 24 through 25, 2006. Audit results showed all systems were reporting measurements to within required accuracy limits except the horizontal wind speed measurement system. Based on the second quarter calibration results, it was determined the failure was due electrical noise present in the measurement system only when the wind speed sensor was removed from the tower (see discussion in Section 2.5.1 – Second Quarter 2005). Therefore, no horizontal wind speed data has been corrected or invalidated as a result of audit findings.

Third Quarter 2005
The third quarter 2005 performance audit of the air quality measurement systems was conducted by AMSTech September 13 through 14, 2005. Audit results showed all systems were reporting measurements to within required accuracy limits.

Fourth Quarter 2005
The fourth quarter 2005 performance audit of the air quality and meteorological measurement systems was conducted by AMSTech December 6 through 8, 2005. Audit results showed all systems were reporting measurements to within required accuracy limits.

First Quarter 2006
The first quarter 2005 performance audit of the air quality measurement systems was conducted by AMSTech on March 22, 2006. Audit results showed all systems were reporting measurements to within required accuracy limits.

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 SECOR Air Resources Laboratory in Fort Collins, Colorado was conducted during June and July 2006. 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 SECOR 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 nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate less than 10 µm in diameter (PM_{10}), and ozone (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 0.002 ppm, compared to the annual NO_2 AAAQS of 0.053 ppm. The annual average NO_2 concentration is just above instrument detection level and only 3.8 percent of the NO_2 AAAQS. The annual average measured this year is lower than the historical Nuiqsut Station average of 0.004 ppm and equal to the annual average measured the previous year.

The variation of average hourly NO_2 concentration by wind direction this year was typical of past years with an approximate negative 0.002 to 0.003 ppm average offset. This offset is consistent with the difference between the historical and current years annual averaged 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 through east-southeast). Slightly higher concentrations occur for wind directions that place the station downwind of Nuiqsut (southeast through southwest wind directions). Except for the overall 0.002 ppm decrease, the difference in the two trends were minor (i.e. on the scale of the measurement accuracy) and not significant. 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 very little 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.

TABLE 3-1

MEASURED NITROGEN DIOXIDE DATA SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Monitoring Period	Year	Period Mean (ppm)	Number of Exceedances
2nd Qtr.	2005	0.001	None
3rd Qtr.	2005	0.001	None
4th Qtr.	2005	0.001	None
1st Qtr.	2006	0.002	None
Annual	2005	0.002	None

NAAQS/AAAQS:

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

TABLE 3-2

MEASURED SULFUR DIOXIDE DATA SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 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.	2005	0.003	0.003	0.001	0.001	0.000	None
3rd Qtr.	2005	0.001	0.001	0.001	0.001	0.000	None
4th Qtr.	2005	0.002	0.002	0.001	0.001	0.000	None
1st Qtr.	2006	0.002	0.002	0.001	0.001	0.000	None
Annual	2005	0.003	0.003	0.001	0.001	0.000	None

NAAQS/AAAQS:

- 3-hour - 0.5 ppm (1,300 $\mu g/m^3$) – 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.

TABLE 3-3

MEASURED PM_{10} DATA SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Monitoring Period	Year	24-hour ($\mu g/m^3$)		Period Mean ($\mu g/m^3$)	Number of Exceedances
		1st high	2nd high		
2nd Qtr.	2005	109	44.9	10.2	None
3rd Qtr.	2005	**331**	**292**	22.2	2
4th Qtr.	2005	21.2	16.3	7.5	None
1st Qtr.	2006	23.5	12.7	6.1	None
Annual	2005	**331**	**292**	11.8	2

NAAQS/AAAQS:

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

TABLE 3-4

MEASURED OZONE DATA SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Monitoring Period	Year	8-hour (ppm)			Period Mean (ppm)	Number of Exceedances
		1st high	2nd high	4th high		
2nd Qtr.	2005	0.049	0.049	0.048	0.018	None
3rd Qtr.	2005	0.042	0.042	0.040	0.016	None
4th Qtr.	2005	0.028	0.028	0.028	0.020	None
1st Qtr.	2006	0.041	0.041	0.041	0.022	None
Annual	2005	0.049	0.049	0.048	0.019	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.

FIGURE 3-1

AVERAGE NO_2 CONCENTRATION BY WIND DIRECTION
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

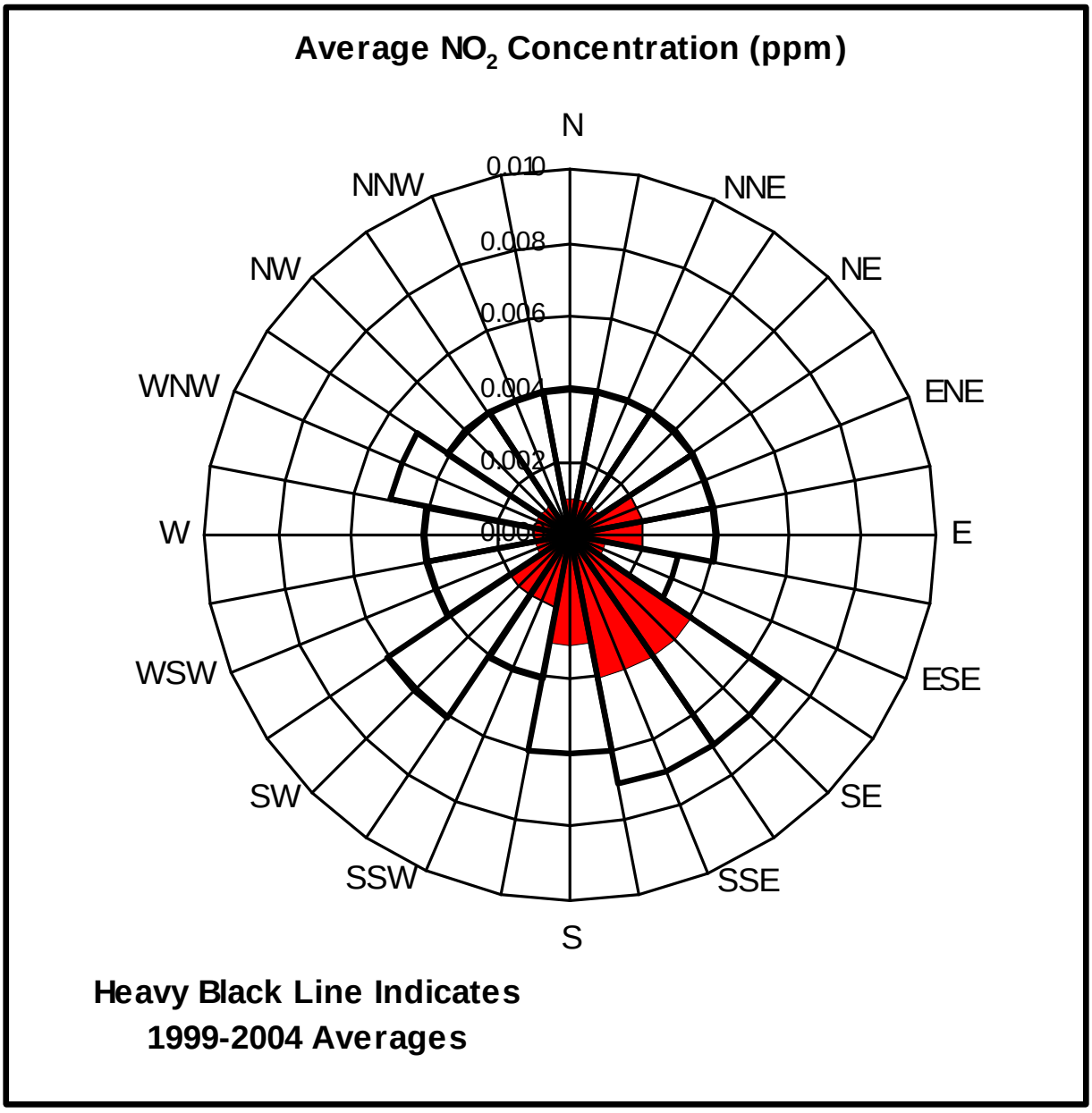
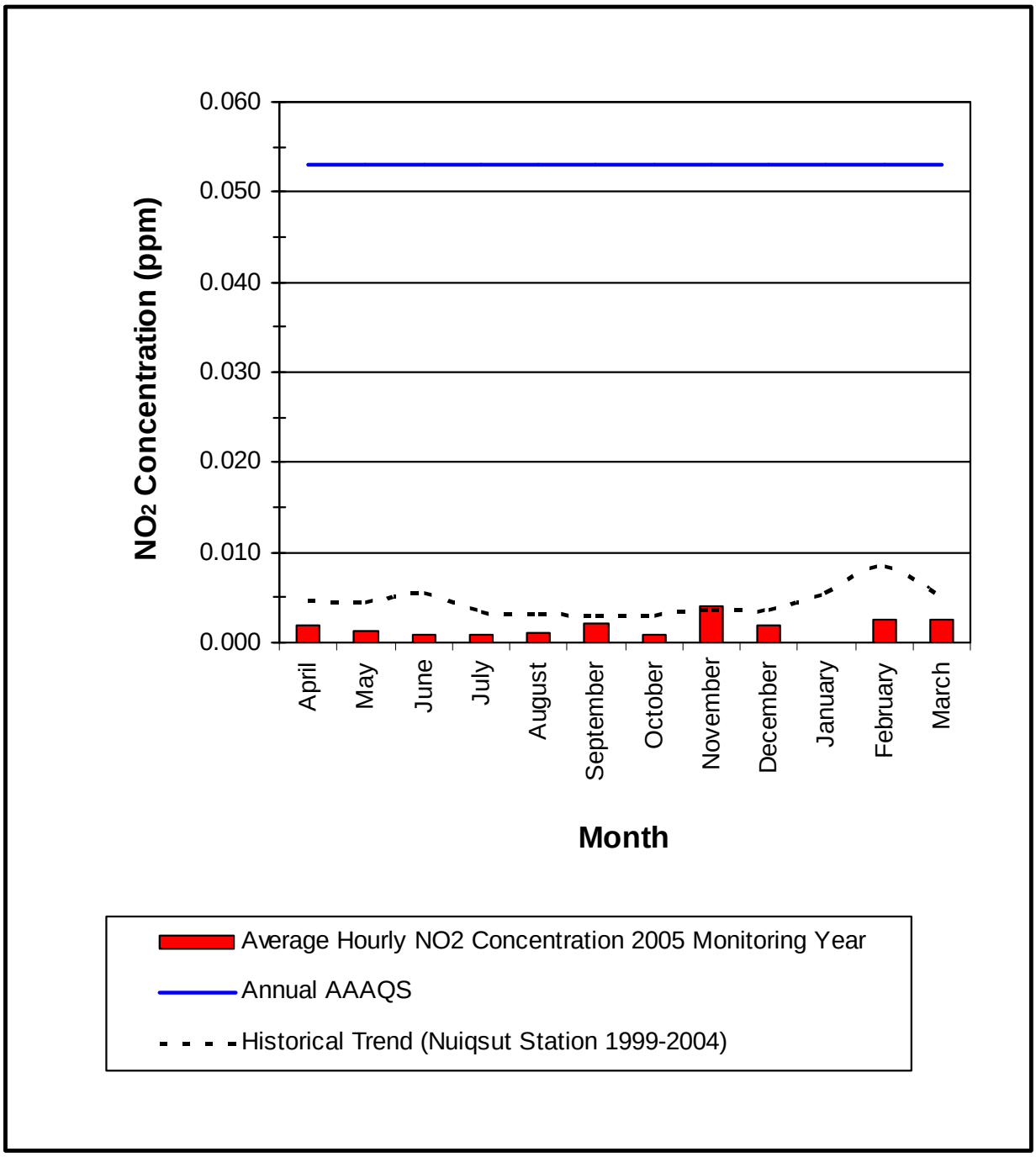


FIGURE 3-2

AVERAGE NO_2 CONCENTRATION BY MONTH
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 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 (1999-2004) values.

Measured hourly SO_2 concentrations were less than 0.003 ppm 99 percent of the monitoring year. No hourly concentrations were greater than 0.003 ppm. 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 result from naturally occurring wind blown 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 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 through south-southeast of the station, and
- to a lesser degree, disturbed ground associated with dirt roads within Nuiqsut south 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 could be attributed to forest fires. When particulate from local fugitive dust and smoke is not present (i.e., during winter), hourly concentrations decrease to at or below the instrument detection limit.

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 331 μg/m^3. This is more than twice the 24-hour AAAQS, and significantly higher than the maximum 24-hour concentration of 33.9 μg/m^3 measured during the previous monitoring year. The yearly average PM_{10} concentration was 11.8 μg/m^3. This is well below the annual AAAQS of 50 μg/m^3 but above the historical Nuiqsut Station average of 7.6 μg/m^3.

This year, the 10 highest measured 24-hour average PM_{10} concentrations were greater than 48 μg/m^3 and associated with four periods; May 18, 2005, July 19, 2005, July 25 through 28,

2005, and September 26 through 29, 2005. During all four periods, on-site technician observations indicate measured concentrations resulted from naturally occurring wind blown fugitive dust from the Nechelik Channel banks north-northeast through east-southeast of the station. These observations are consistent with a statistical analysis of hourly concentrations measured during the four periods. That analysis shows that for hours when measured concentrations contributed significantly to the daily average (i.e., hours corresponding to concentrations greater than the 25th percentile of all measured concentrations on a particular day) wind speeds ranged from 12 to 14 meters per second and wind directions ranged from 72 to 95 degrees. Therefore, it is clear that at least the 10 highest measured concentrations and possibly others are the result of a naturally occurring event. This naturally occurring event can likely be classified as an exceptional event and data collected during the event can be excluded when calculating background concentrations according to proposed revisions to 40 CFR Parts 50 and 51[1].

Figure 3-3 shows annual average hourly PM_{10} concentrations by wind direction measured this year compared to the historical trend. Except for concentrations associated with northeasterly through easterly wind directions, concentrations for all wind directions were similar to historical annual averages and approximately half the overall annual average. Directional dependence is related to influence of local fugitive dust sources discussed previously. Anomalously high averages associated with northeasterly through easterly wind directions are related to the exceptional events 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 except in July and September when concentrations from the exceptional events previously discussed caused anomalously high hourly concentrations. 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.

[1] The proposed rule was signed by the Administrator on March 1, 2006 and published in the Federal Register on March 10, 2006 (71 FR 12592).

FIGURE 3-3

AVERAGE PM_{10} CONCENTRATION BY WIND DIRECTION
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

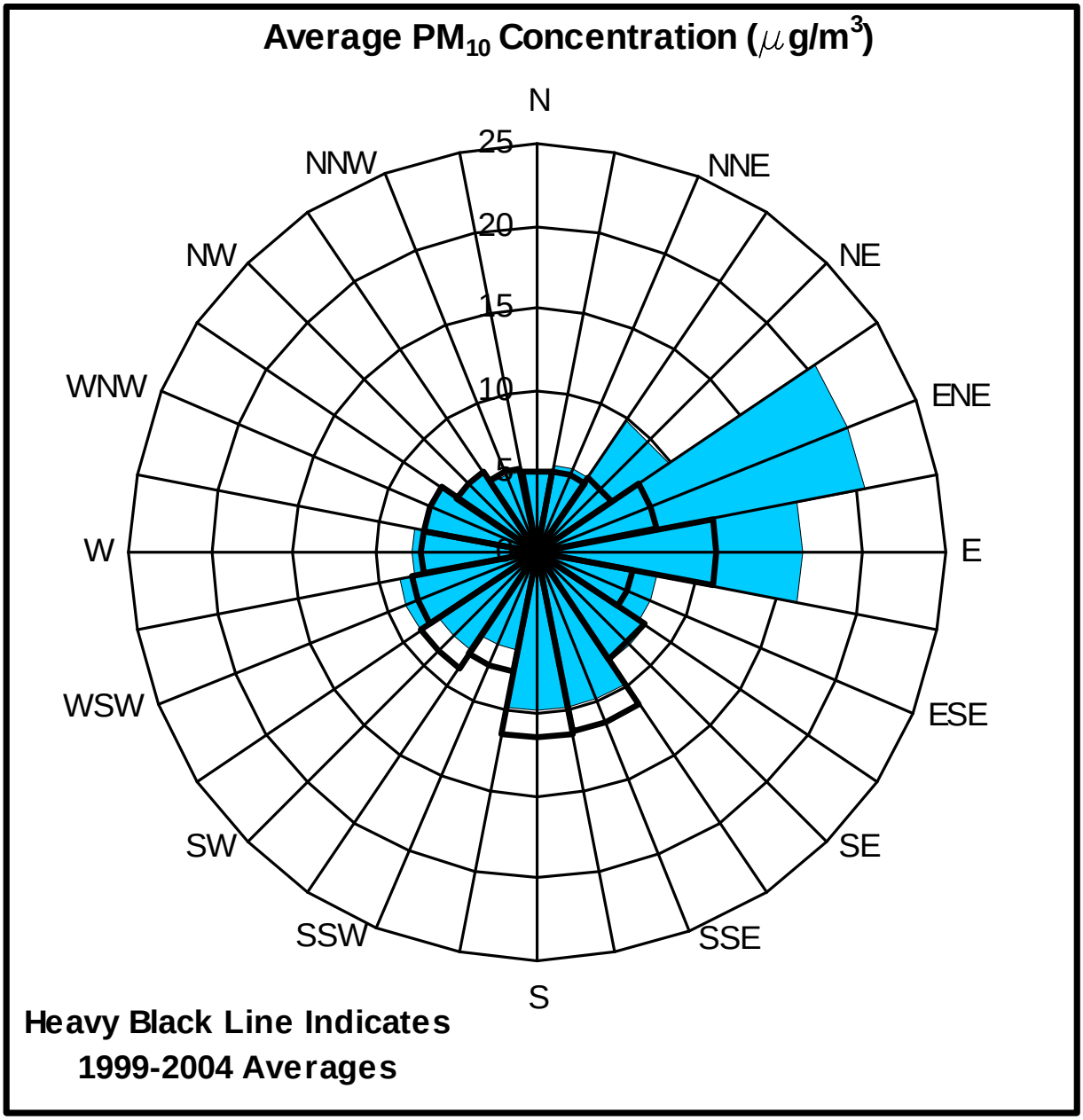
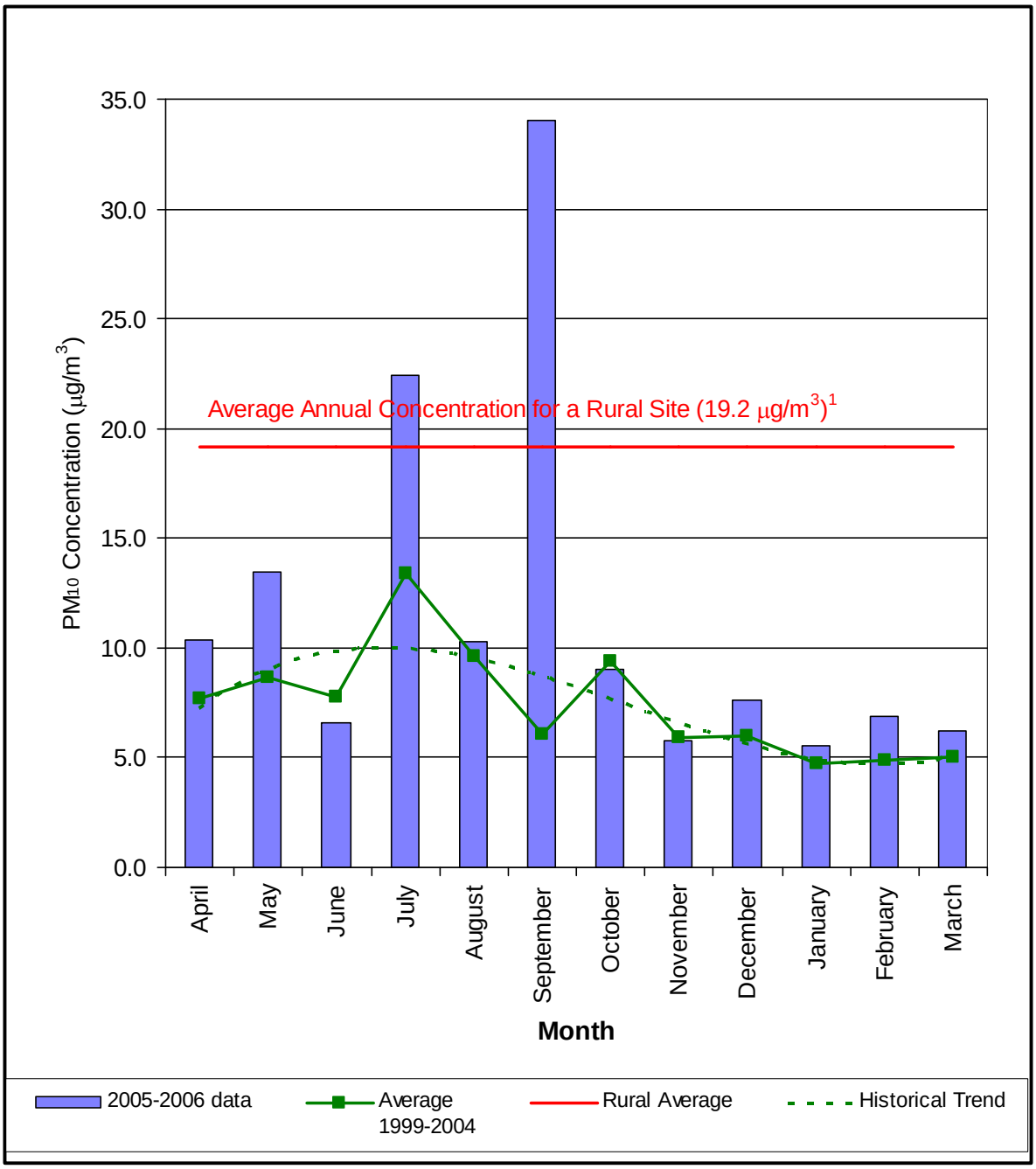


FIGURE 3-4

AVERAGE PM_{10} CONCENTRATION BY MONTH
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 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).

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 homogenous and representative of a regional background.

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 through easterly (NE-E) and to a lesser degree south-southwest 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 4.9 m/s and the maximum was 19.2 m/s.

The persistence of weather patterns season to season can be inferred from Figure 3-6 through Figure 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.

3.2.2 Temperature Climatology

During the monitoring year, the hourly averaged 2-meter ambient temperature reached a maximum of 26.3°C (79.3°F) on August 10, 2005 and a minimum of -44.1°C (-47.4°F) on February 3, 2006. The Nuiqsut Station temperature climatology presented in Table 3-9 shows these annual hourly maximum and minimum did not set any records. Therefore, extremes measured this year are consistent with those historically measured. This conclusion is a little different when viewed on a monthly basis. Table 3-9 shows the monthly hourly minimum was broken for March and the hourly maximum was broken for February.

Figure 3-10 shows the February and March hourly extremes are representative of the monthly average. 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.

FIGURE 3-5

ANNUAL NUIQSUT WIND ROSE
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

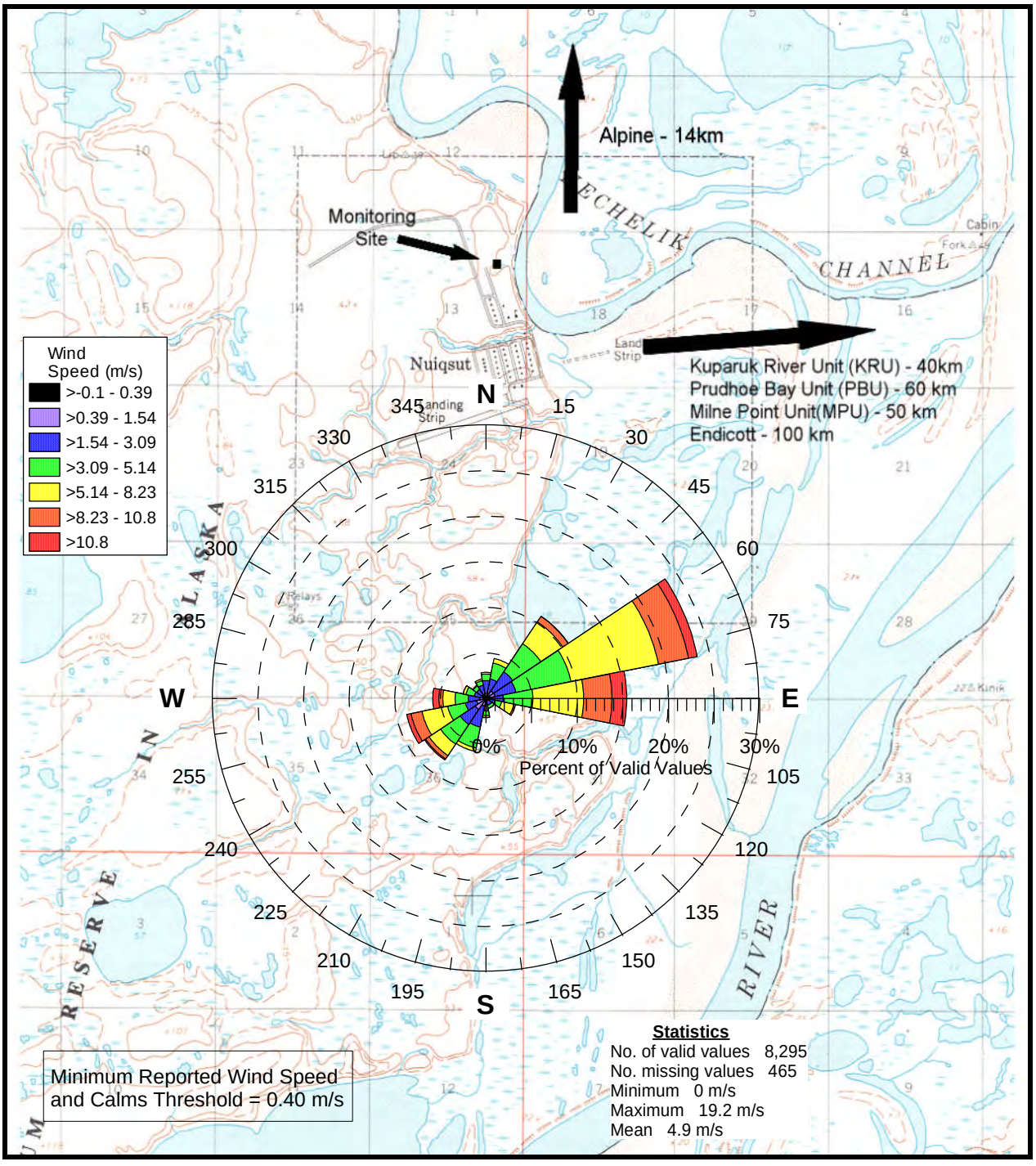


FIGURE 3-6

SECOND QUARTER 2005 NUIQSUT WIND ROSE
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

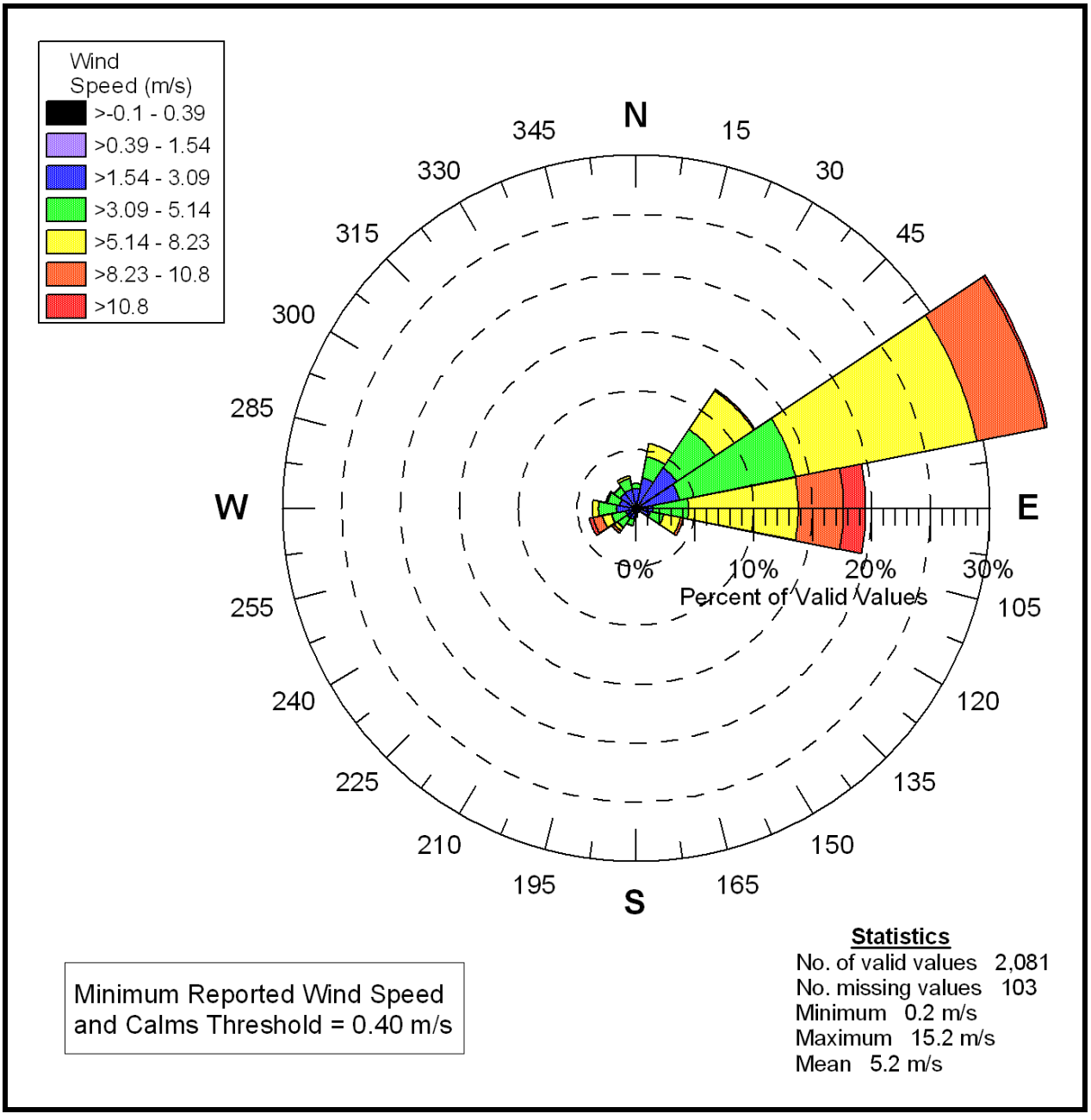


FIGURE 3-7

THIRD QUARTER 2005 NUIQSUT WIND ROSE
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

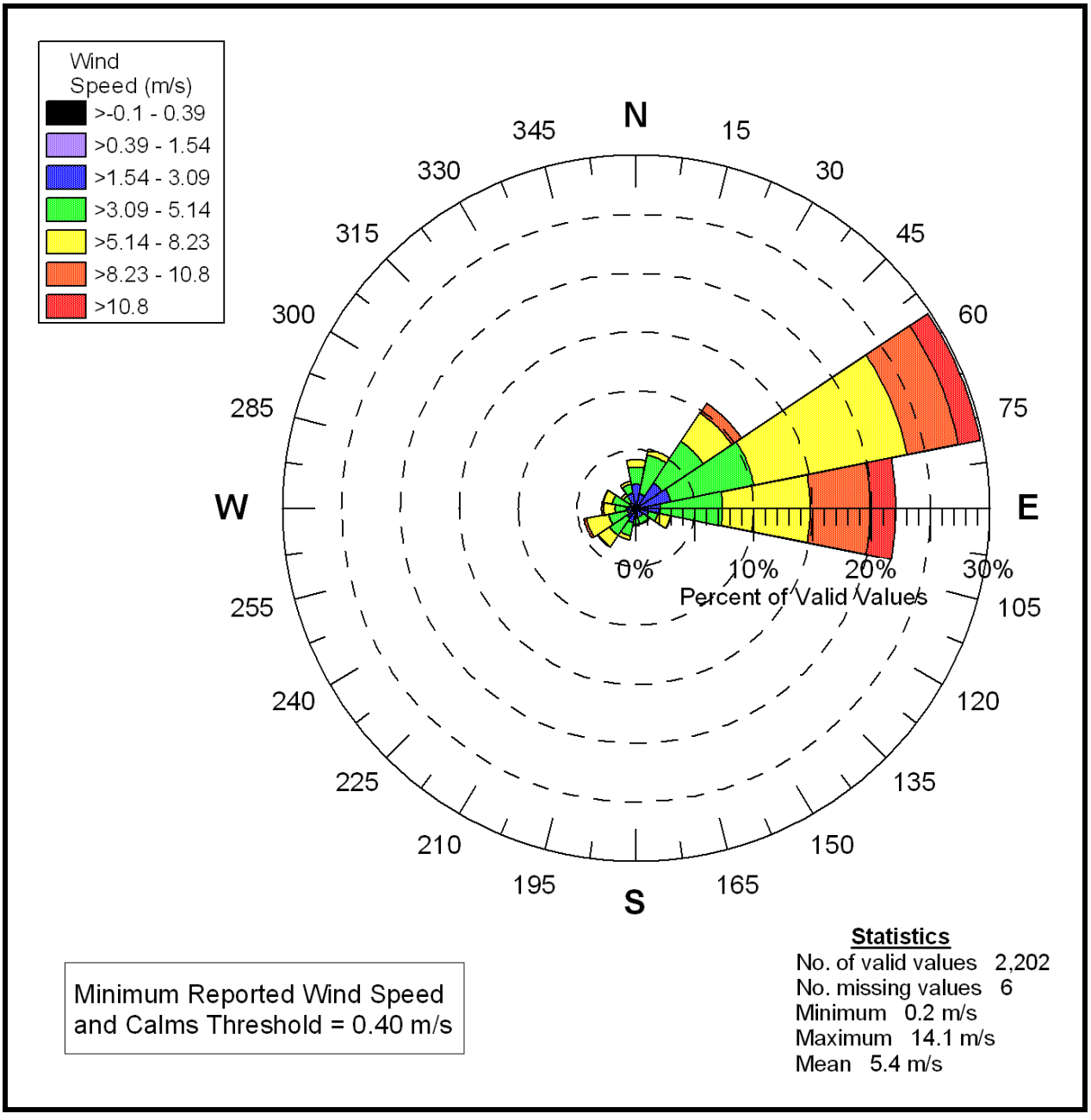


FIGURE 3-8

FOURTH QUARTER 2005 NUIQSUT WIND ROSE
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

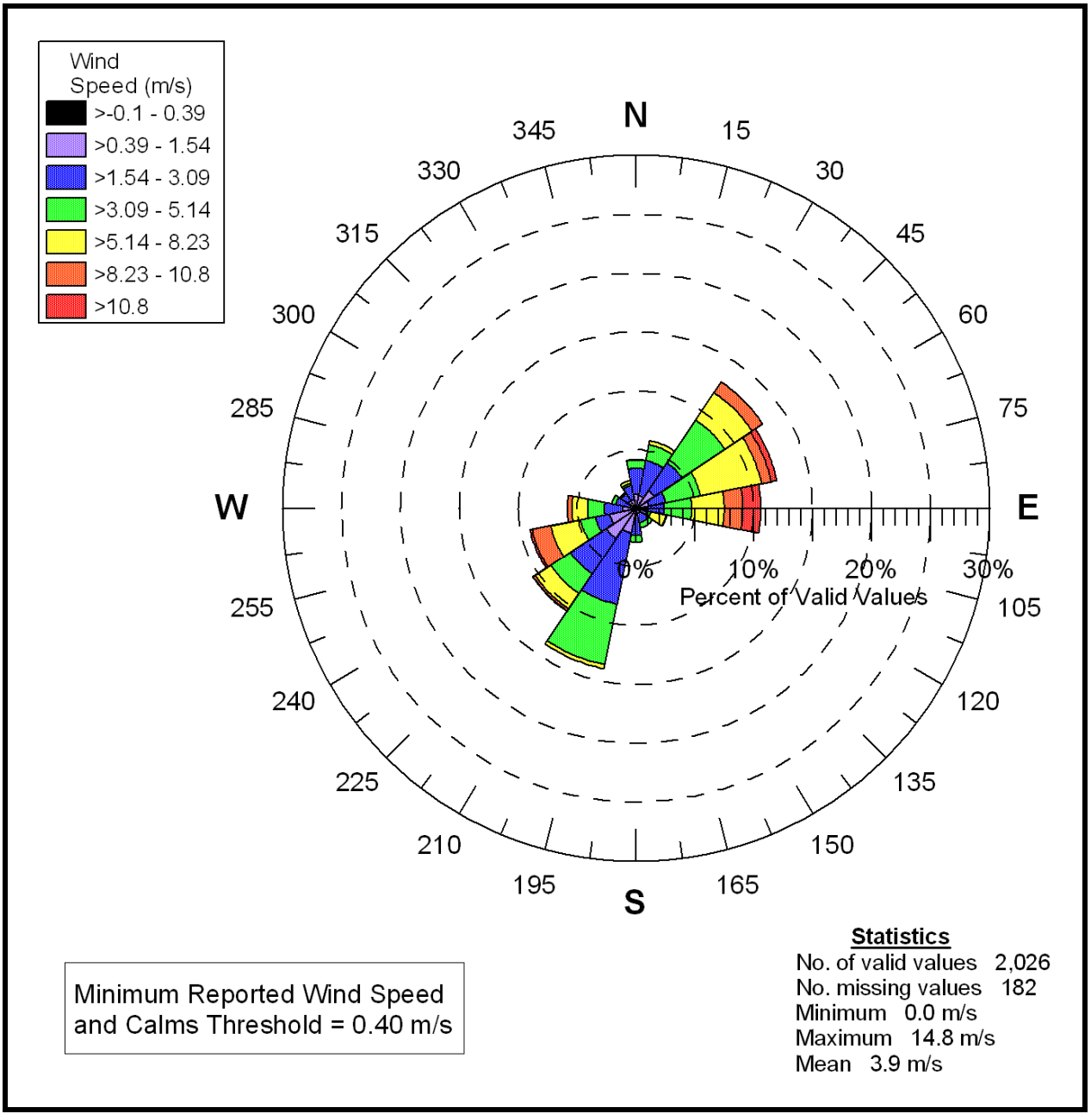


FIGURE 3-9

FIRST QUARTER 2006 NUIQSUT WIND ROSE
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

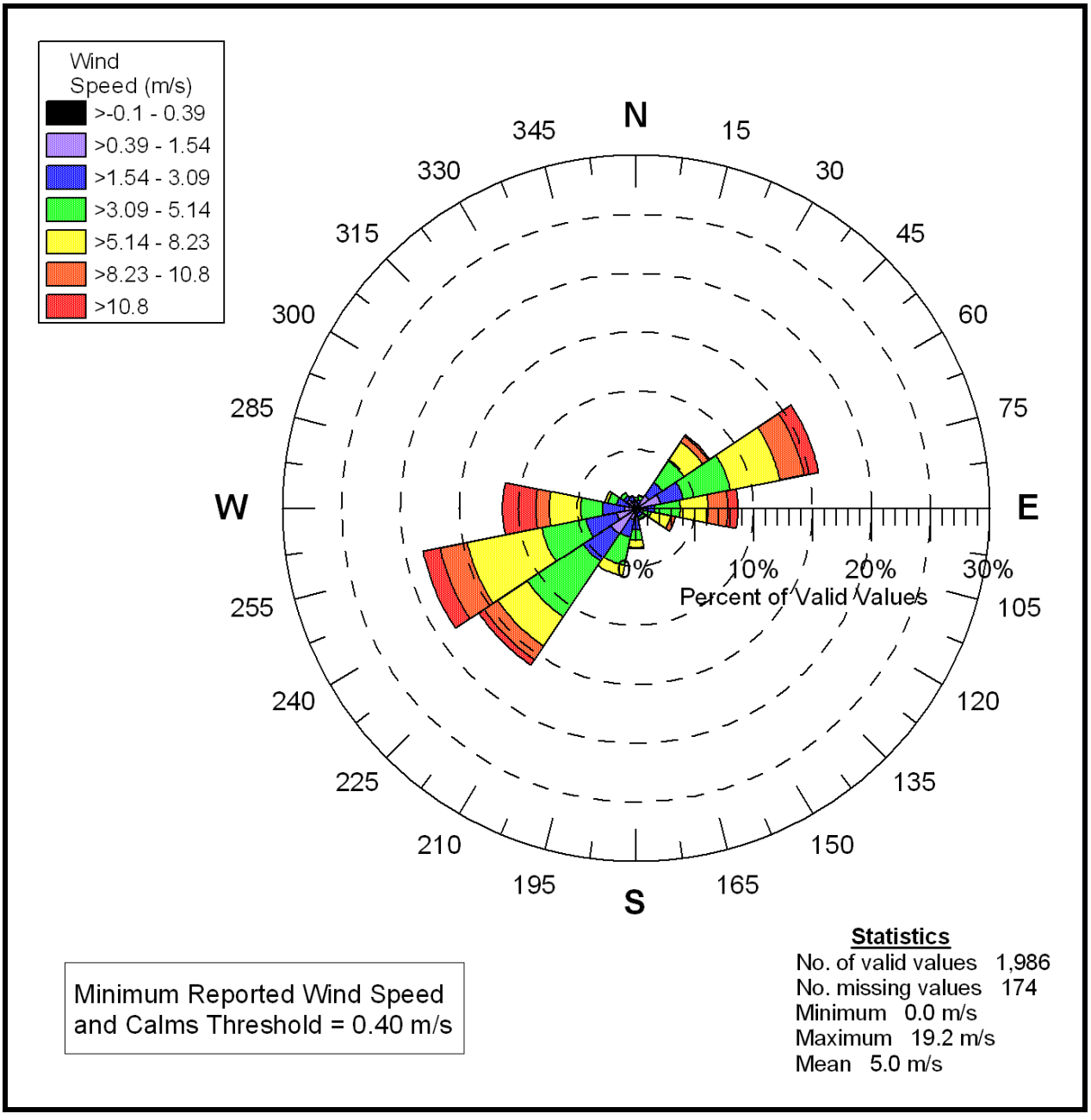


TABLE 3-5

SECOND QUARTER 2005 WIND DIRECTION/SPEED FREQUENCY ANALYSIS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Wind Rose Analysis – Percent of Valid Hourly Values (2,081 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		0.53	2.55	1.49	0.53	0.00	0.00	5.11	3.13
NE		1.30	6.58	10.76	11.68	2.02	0.00	32.36	4.86
E		0.53	3.27	8.55	19.51	8.07	2.11	42.07	6.48
SE		0.43	0.72	0.19	0.00	0.00	0.00	1.36	2.12
S		0.43	0.67	0.29	0.00	0.00	0.00	1.41	2.25
SW		0.34	1.59	1.68	0.77	0.62	0.14	5.16	4.55
W		0.53	2.26	3.36	0.96	0.43	0.19	7.75	4.14
NW		0.72	2.59	1.25	0.19	0.00	0.00	4.78	2.74
CALM	0.14								
Total	0.14	4.81	20.23	27.58	33.64	11.15	2.45	100	

TABLE 3-6

THIRD QUARTER 2005 WIND DIRECTION/SPEED FREQUENCY ANALYSIS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Wind Rose Analysis – Percent of Valid Hourly Values (2,202 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		0.27	3.13	3.18	0.95	0.00	0.00	7.54	3.56
NE		0.64	4.00	9.13	7.81	2.36	0.54	24.48	5.21
E		0.73	3.72	10.35	16.85	8.22	3.50	43.38	6.45
SE		0.45	1.36	0.73	0.45	0.00	0.00	3.00	3.19
S		0.14	1.41	1.50	0.36	0.00	0.00	3.41	3.50
SW		0.41	1.77	3.00	2.36	0.14	0.00	7.68	4.40
W		0.50	0.82	2.86	2.27	0.32	0.00	6.77	4.76
NW		0.27	1.23	1.50	0.68	0.05	0.00	3.73	3.81
CALM	0.05								
Total	0.05	3.41	17.44	32.24	31.74	11.08	4.04	100	

TABLE 3-7

FOURTH QUARTER 2005 WIND DIRECTION/SPEED FREQUENCY ANALYSIS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Wind Rose Analysis – Percent of Valid Hourly Values (2,026 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		2.02	5.03	1.33	0.25	0.00	0.00	8.79	2.37
NE		2.96	4.74	6.96	5.38	1.23	0.00	21.43	4.20
E		1.43	2.62	3.90	7.06	2.32	2.02	19.50	5.87
SE		0.59	1.28	0.69	0.00	0.00	0.00	2.72	2.42
S		1.38	4.84	3.06	0.05	0.00	0.00	9.48	2.70
SW		5.87	7.60	5.63	3.36	1.33	0.20	24.14	3.46
W		2.02	3.16	2.27	2.42	0.89	0.05	10.96	4.00
NW		1.14	1.28	0.30	0.10	0.00	0.00	2.97	2.07
CALM	1.23								
Total	1.23	17.42	30.55	24.14	18.61	5.77	2.27	100	

TABLE 3-8

FIRST QUARTER 2006 WIND DIRECTION/SPEED FREQUENCY ANALYSIS
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

Wind Rose Analysis – Percent of Valid Hourly Values (1,986 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		0.81	0.50	0.40	0.00	0.00	0.00	1.92	2.04
NE		2.72	2.62	4.28	3.68	2.17	0.35	16.02	4.70
E		1.46	2.01	4.88	6.39	2.57	1.91	19.44	5.86
SE		0.55	0.70	0.35	0.45	0.05	0.00	2.32	3.19
S		1.46	2.22	1.71	1.01	0.15	0.00	6.75	3.25
SW		3.27	4.73	10.22	7.05	2.82	1.26	29.56	4.85
W		2.06	3.93	3.27	5.89	2.06	3.58	21.00	5.82
NW		1.01	0.91	0.86	0.00	0.00	0.00	2.98	2.31
CALM	1.66								
Total	1.66	13.34	17.62	25.98	24.47	9.82	7.10	100	

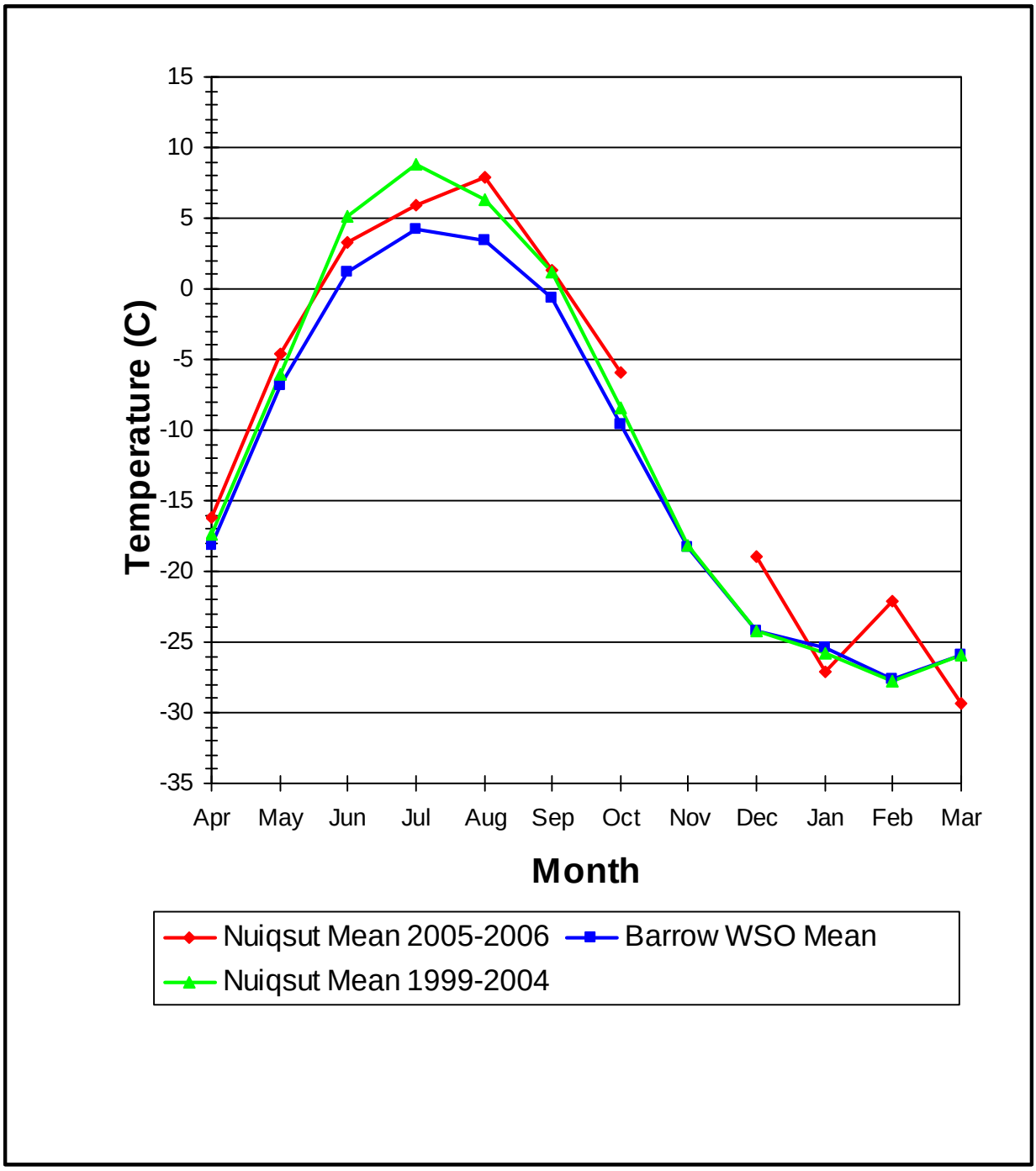
TABLE 3-9

NUIQSUT TEMPERATURE CLIMATE SUMMARY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY

2-Meter Temperature (°C)									
	Mean			Extreme					
Month	Maximum Daily (Monthly Average)	Minimum Daily (Monthly Average)	Monthly	Record Highest (Hourly Average)	Year	Day	Record Lowest (Hourly Average)	Year	Day
April 2005	-3.8	-28.2	-16.2	2.5	2002	26	-35.8	2004	2, 3
May 2005	0.2	-13.2	-4.7	18.5	2002	24	-28.7	2001	1
June 2005	14.6	-1.3	3.3	27.3	2003	29	-5.0	2000	5
July 2005	12.6	2.0	5.9	28.0	2001	16	-1.6	2002	26
August 2005	17.9	1.2	7.9	27.8	1999	5	-3.3	2000	27
September 2005	7.0	-3.0	1.4	18.8	2002	5	-13.6	1999	30
October 2005	-1.2	-10.7	-5.9	7.4	2003	2	-27.2	1999/ 2004	31/31
November 2005	N.A.	N.A.	N.A.	0.7	2003	6	-35.5	1999	5
December 2005	-12.0	-26.0	-18.9	-2.5	2001	28	-42.1	1999	18
January 2006	-17.4	-38.3	-27.1	0.6	2005	8	-43.1	2002	23
February 2006	-2.6	-42.8	-22.2	1.8	2006	16	-45.9	2004	19
March 2006	-22.5	-38.7	-29.3	-3.1	2004	21	-40.3	2006	11
2nd Qtr. 2005	3.6	-14.2	-5.3	-	-	-	-	-	-
3rd Qtr. 2005	12.2	0.1	4.9	-	-	-	-	-	-
4th Qtr. 2005	-4.4	-12.4	-12.2	-	-	-	-	-	-
1st Qtr. 2006	-14.6	-39.8	-26.3	-	-	-	-	-	-
Monitoring Year	-0.6	-16.5	-9.2	28.0	2001	16	-45.9	2004	19

FIGURE 3-10

NUIQSUT STATION TEMPERATURE CLIMATOLOGY
CONOCOPHILLIPS ALASKA INC.
NUIQSUT AQ MONITORING PROGRAM 2005 ANNUAL DATA SUMMARY



Monthly averaged temperatures measured this year displayed much more variability month to month than typically seen and this year, warmer temperatures were delayed by a month and persisted longer into the winter. 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. Contrary to previous years, Nuiqsut Station temperatures measured from October through March this year were two to five degrees higher than the long-term Barrow and the Nuiqsut Station historical averages except in January and March when temperatures were cooler than normal by as much as 4 degrees.

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