One-Year PM_{10} Monitoring Data Report
April 1, 2004 – March 31, 2005

for the

Rock Creek Ambient Air Monitoring Project

Nome, Alaska

November 2005

prepared for

Alaska Gold Company

prepared by

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Executive Summary

This report presents PM_{10} monitoring results for the Rock Creek Air Monitoring Program. Ambient concentrations of particulate matter less than 10 microns in effective aerodynamic diameter (PM_{10}) were measured for a period of one year. The monitoring results show compliance with the 18 Alaska Administrative Code (AAC) 50.010 standards of 50 µg/m^3 annual PM_{10} concentration and 150 µg/m^3 maximum daily PM_{10} concentration.

Table E-1
AAAQS Ambient Air Monitoring Table

Date	Average		1st High Value		2nd High Value		AAAQS Exceedances
	Main (µg/m^3)	Co-located (µg/m^3)	Main (µg/m^3)	Co-located (µg/m^3)	Main (µg/m^3)	Co-located (µg/m^3)	
2nd Quarter	4	4	12	8	10	7	150 µg/m$_3$
% of AAAQS	*2.7%*	*2.7%*	*8.0%*	*5.3%*	*6.6%*	*4.6%*	
3rd Quarter	8	12	75	77	18	19	
% of AAAQS	*5.3%*	*8.0%*	*50%*	*51.3%*	*12.0%*	*12.6%*	
4th Quarter	4	4	9	8	8	7	
% of AAAQS	*2.7%*	*2.7%*	*6.0%*	*5.3%*	*5.3%*	*4.6%*	
1st Quarter	4	5	9	9	7	6	
% of AAAQS	*2.7%*	*3.3%*	*6.0%*	*6.0%*	*4.6%*	*4.0%*	
Annual	5	6	n/a	n/a	n/a	n/a	50 µg/m$_3$

Table E-2
QAPP Variation Table

Item/Procedure	Summary of Variation	Explanation
Monitoring Period	The reporting period will be from April 1, 2004 through March 31, 2005.	Data collected during the 1st quarter 2004 fell below the required 80 percent data completeness, Monitoring was continued through the end of the 1st quarter 2005 to obtain one full year of monitoring data that met the >80%/quarter criteria.

1.0 INTRODUCTION

1.1 Project Summary

This project was being conducted by Alaska Gold Company to collect baseline ambient air quality data at Rock Creek that may be used for an Environmental Assessment and an air quality construction permit application, if such a permit is determined to be necessary. These data could provide a one-year air quality baseline prior to the start of any construction activities, should a Prevention of Significant Deterioration (PSD) review be required.

Meteorological monitoring was also conducted at Rock Creek during this period. The meteorological data are presented in a separate report.

The Rock Creek site is located about 7 miles north of Nome adjacent to Glacier Creek Road. Figures 1-1 and 1-2 are maps of the Rock Creek area. Rock Creek is located near the southern coast of Alaska's Seward Peninsula at 64° 37' N latitude and 165° 26' W longitude.

1.2 Measurement Methods

The Rock Creek Air Monitoring Program includes monitoring ambient concentrations of particulate matter less than 10 microns in effective aerodynamic diameter (PM_{10}). Monitoring has occurred over a period of 12 months. The data collected in this project will consist of 24-hour average PM_{10} concentrations from filter-based low-volume (16.7 liters per minute [L/min]) samplers. A photograph of the monitoring station is included as Figure 1-3.

Ambient PM_{10} concentrations are determined using BGI PQ100 PM_{10} Air Samplers. This monitor is designated by the US Environmental Protection Agency (EPA) as Manual Reference Method RFPS-1298-124 for PM_{10}, consistent with the "Ambient Monitoring Guidelines for Prevention of Significant Deterioration" (EPA-450/4-87-007), and meets the requirements of the Alaska Department of Environmental Conservation (ADEC). These samplers are run on battery power because the monitoring site does not have line AC power. Average 24-hour PM_{10} samples are collected every 3 days according to the 3- and 6-day sampling schedule adopted by EPA for the National Ambient Monitoring Stations (NAMS) network and the State/Local Ambient Monitoring Stations (SLAMS) network. Co-located PM_{10} samples are collected on a 6-day sample schedule to determine the PM_{10} method precision.

1.3 Variations from QAPP

The project manager for IML Air Sciences is Jason Rogers. The proposed PM_{10} monitoring period was adjusted from the original schedule. Data acquired during the 1st quarter 2004 fell below the required 80 percent data completeness. Monitoring was conducted for an additional quarter, and the final PM_{10} reporting period was the from April 1, 2004 through March 31, 2005.

Figure 1-1 Project Location Map

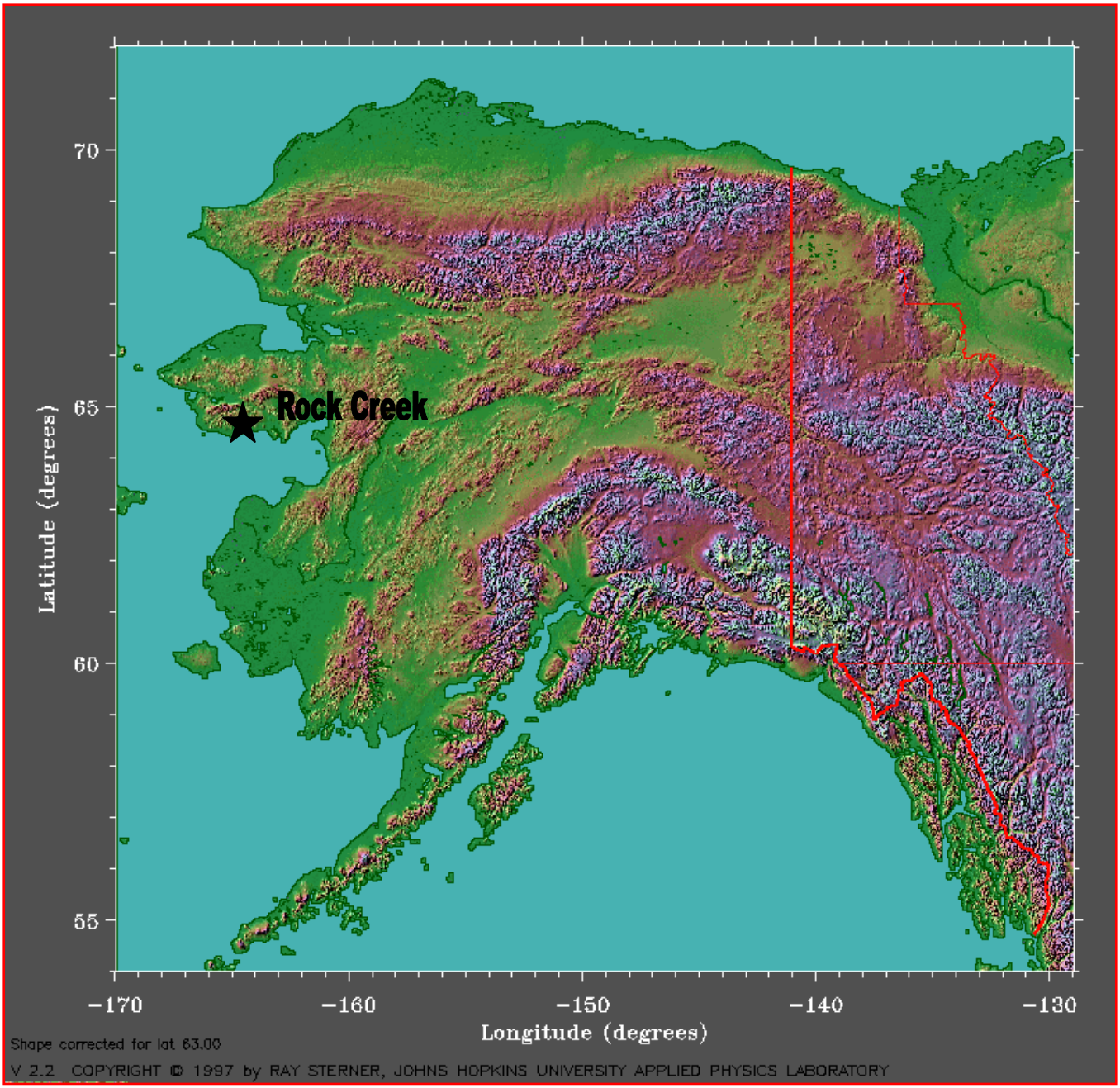


Figure 1-2 Rock Creek Development and Surrounding Area Map

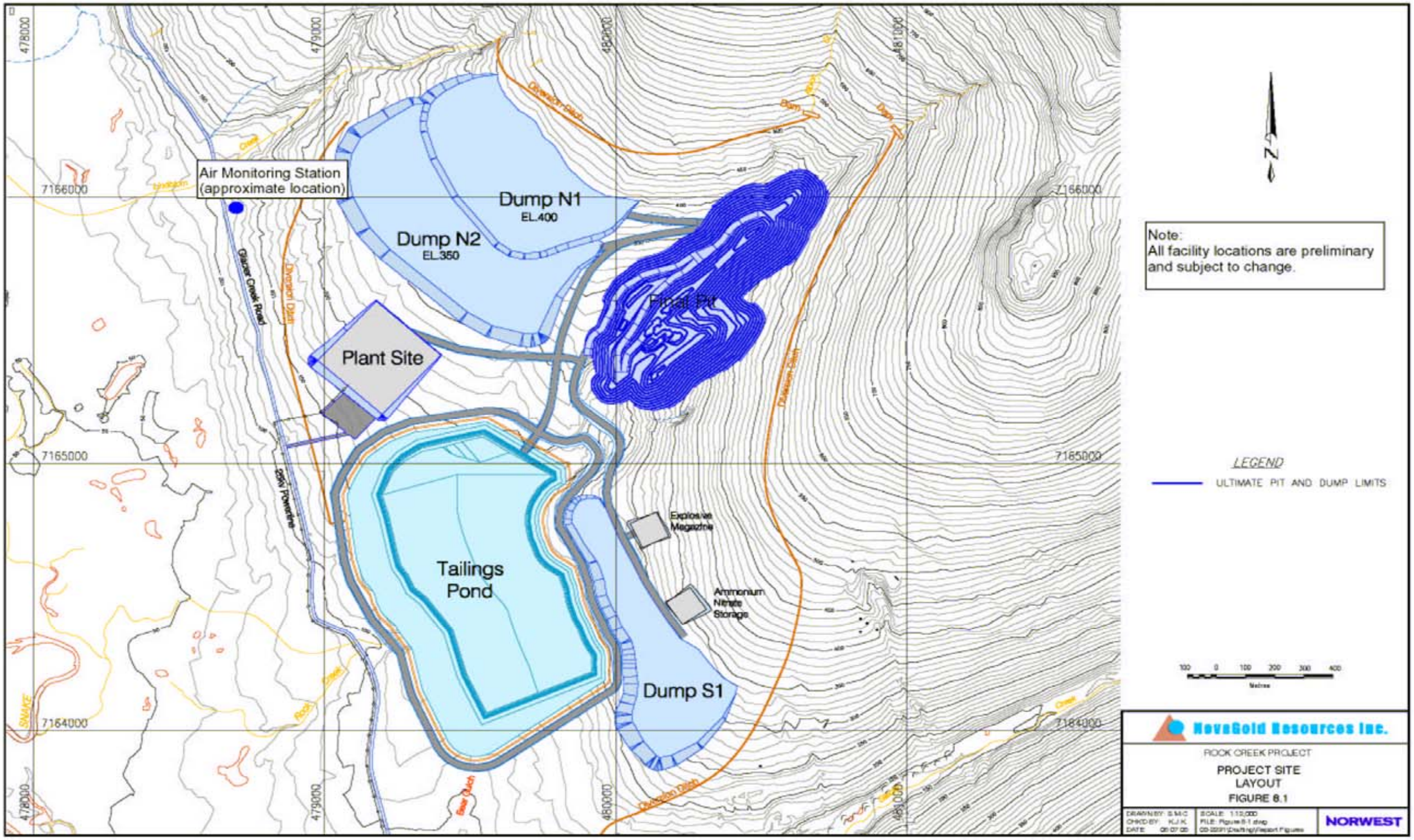


Figure 1-3
Rock Creek Monitoring Station

2.0 STATION PERFORMANCE SUMMARY

2.1 Significant Project Events

Table 2-1 summarizes the log of significant events at the Rock Creek monitoring station.

Table 2-1
Chronology of Significant Events

Date	Event
December 11-17, 2003	Initial site installation and setup
January 9, 2004	Flow audit of PM_{10} samplers. PM_{10} training for site technicians.
May 28, 2004	Flow audit of PM_{10} samplers.
September 23, 2004	Flow audit of PM_{10} samplers.
December 28, 2004	Flow audit of PM_{10} samplers.
March 15, 2005	Flow audit of PM_{10} samplers.

2.2 Missing, Invalid and Adjusted Data

Data known or suspected to be invalid have been removed from the data set. A number of reasons exist for data to be considered invalid. In some instances, technical difficulties occurred, such as flow calibration failure, battery failure, or failure to record sample volume. Weather and environmental conditions such as extreme cold temperatures, heavy smoke from regional forest fires, and heavy snowfall also contributed to invalid data.

The 1st quarter 2004 data set is considered invalid because the set did not meet the data quality objective of 80 percent data completeness. Therefore, an additional quarter of data was collected and the annual reporting period will be from April 1, 2004, to March 31, 2005.

2.3 Network Data Completeness

The PSD goal for annual valid data recovery is 80 percent for air quality parameters (PM_{10}). Additionally, four consecutive quarters, each with at least 80 percent valid data recovery, should be obtained for a complete one-year database.

Quarterly data completeness is provided in Table 2-2. Calculations for determining data completeness are provided in Appendix A.

Table 2-2
Quarterly Data Completeness

PM_{10}			
Period	**Main**	**Co-located**	**Both**
April 2004	70.0%	60.0%	70.0%
May 2004	80.0%	100.0%	90.0%
June 2004	80.0%	100.0%	90.0%
2nd Quarter	**76.7%**	**86.7%**	**83.3%**
July 2004	100.0%	100.0%	100.0%
August 2004	72.7%	66.7%	72.7%
September 2004	80.0%	100.0%	90.0%
3rd Quarter	**83.9%**	**87.5%**	**87.1%**
October 2004	100.0%	80.0%	100.0%
November 2004	100.0%	60.0%	100.0%
December 2004	80.0%	100.0%	80.0%
4th Quarter	**93.3%**	**80.0%**	**93.3%**
January 2005	90.9%	40.0%	90.9%
February 2005	77.8%	60.0%	77.8%
March 2005	100.0%	100.0%	100.0%
1st Quarter	**90.0%**	**66.7%**	**90.0%**
YTD[1]	**86.0%**	**80.3%**	**90.1%**

2.4 Precision Statistics

2.4.1 Monitoring Network Precision Statistics

Individual precision statistics are provided in Table 2-3. Precision statistics were determined using the methods in 40 Code of Federal Regulation (CFR) Part 58, Appendix B.

[1] For the purposes of this report, the annual reporting period will be from April 1, 2004, to March 31, 2005.

Table 2-3
Monitoring Network Precision Statistics

Period	Main ($\mu g/m^3$)	Co-located ($\mu g/m^3$)	% Difference	Average % Difference	Standard Deviation	Upper 95% Limit	Lower 95% Limit
2nd Quarter 2004							
4/3/04	invalid	invalid	-	0.55	58.0	80.9	-79.8
4/9/04	2	3	40				
4/15/04	5	5	0				
4/21/04	3	2	-40				
4/27/04	12	invalid	-				
5/3/04	6	1	-143				
5/9/04	3	8	91				
5/15/04	2	2	0				
5/21/04	3	3	0				
5/27/04	invalid	1	-				
6/2/04	3	4	29				
6/8/04	6	8	29				
6/14/04	invalid	5	-				
6/20/04	7	7	0				
6/26/04	2	2	0				
3rd Quarter 2004							
7/2/04	18	19	5	11.4	29.8	52.7	-30.0
7/8/04	4	5	22				
7/14/04	5	5	0				
7/20/04	5	5	0				
7/26/04	11	11	0				
8/1/04	5	5	0				
8/7/04	4	4	0				
8/13/04	2	5	86				
8/19/04	12	invalid	-				
8/25/04	75	77	3				
8/31/04	invalid	invalid	-				
9/6/04	5	4	-22				
9/12/04	invalid	6	-				
9/18/04	9	7	-25				
9/24/04	3	4	29				
9/30/04	3	5	50				

Table 2-3 (continued)
Monitoring Network Precision Statistics

Period	Main ($\mu g/m^3$)	Co-located ($\mu g/m^3$)	% Difference	Average % Difference	Standard Deviation	Upper 95% Limit	Lower 95% Limit
4th Quarter 2004							
10/6/04	2	invalid	-	12.2	32.1	56.6	-32.3
10/12/04	2	2	0				
10/18/04	7	8	13				
10/24/04	3	3	0				
10/30/04	4	5	22				
11/5/04	3	3	0				
11/11/04	2	2	0				
11/17/04	6	invalid	-				
11/23/04	3	invalid	-				
11/29/04	4	4	0				
12/5/04	1	3	100				
12/11/04	2	3	40				
12/17/04	3	3	0				
12/23/04	7	7	0				
12/29/04	4	3	-29				
1st Quarter 2005							
1/16/05	7	invalid	-	2.9	44.4	64.4	-58.6
1/22/05	4	2	-67				
1/28/05	9	9	0				
2/3/05	7	6	-15				
2/9/05	3	9	100				
2/16/05	invalid	invalid	-				
2/21/05	2	2	0				
2/27/05	invalid	invalid	-				
3/5/05	2	3	40				
3/11/05	4	3	-29				
3/17/05	6	5	-18				
3/23/05	5	6	18				
3/29/05	4	4	0				

2.4.2 Analytical Laboratory Precision Statistics

Analytical laboratory precision for gravimetric PM samplers will be assessed and reported in Appendix B. Replicate sample data is presented in Part I of Table 2-4 below. Part II of Table 2-4 provides data on the filter conditioning environment.

Table 2-4
Analytical Laboratory Precision – Part I

		Replicate Sample Measurements Pre-Exposure	Replicate Sample Measurements Post-Exposure
No. of Precision Checks	2Q	7	7
	3Q	4	8
	4Q	5	3
	1Q	4	3
Average Difference	2Q	0.001	-0.001
	3Q	-0.006	-0.002
	4Q	-0.005	-0.004
	1Q	-0.006	-0.002
Precision Criteria		0.028	0.050
Maximum Difference	2Q	0.009	0.010
	3Q	-0.002	0.006
	4Q	0.000	-0.001
	1Q	0.002	0.000
Precision Criteria		0.028	0.050

Table 2-5
Analytical Precision Table – Part II

Monitoring Quarter		Temperature (°C)	Relative Humidity (%)
2nd Quarter	Minimum	20.5	33.7
	Maximum	22.3	38.9
	Average	21.4	35.5
3rd Quarter	Minimum	20.7	34.0
	Maximum	22.6	42.9
	Average	21.8	35.3
4th Quarter	Minimum	20.5	33.7
	Maximum	22.2	39.4
	Average	21.0	35.9
1st Quarter	Minimum	20.2	32.7
	Maximum	22.5	40.0
	Average	21.1	36.0
Overall	Minimum	20.2	32.7
	Maximum	22.6	42.9
	Average[2]	21.3	35.7
Precision Criteria		20±3°C	40±5%

2.4.3 Analytical Laboratory Precision Statistics for Lead Analysis

Not applicable.

2.5 Accuracy Statistics

2.5.1 Instrument Calibration Statistics

Not applicable.

2.5.2 Independent Quality Assurance Audits

The initial systems and performance audit of the ambient air monitoring network at Rock Creek was conducted on January 8 and 9, 2004. PM_{10} sampler flow audits were also conducted once per quarter throughout the monitoring period. The combination of systems and performance audits constitute a comprehensive evaluation of a monitoring system. The auditing methods used in these audits are consistent with guidelines

[2] Overall average applies to the period from March 1, 2004, through December 31, 2005.

published by the EPA and ADEC. Additional guidelines were established in the project monitoring plan: Hoefler Consulting Group *Quality Assurance Project Plan for the Rock Creek Ambient Air and Meteorological Monitoring Project, (November 2003).*

Each of the PM10 flow audits passed the applicable criteria specified in the project quality assurance project plan (QAPP). The PM10 flow audit criteria specified in the QAPP are: (a) sampler display flow rate ±10 percent of Transfer Std QC flow rate, and (b) the Transfer Std QC flow rate ±7 percent of design 16.7 L/min flow rate.

Applicable audit reports are provided in Appendix E.

Table 2-6
Performance Audit Accuracy Table

PM_{10}								
Project Monitoring Quarter		**Audit Standard Value**	**Sampler Indicated Reading**	**Percent Difference**	**Average % Difference**	**Standard Deviation**	**Upper 95% Limit**	**Lower 95% Limit**
Primary Sampler	2Q	17.46	16.67	4.7	3.28	1.8	9.27	2.33
	3Q	17.28	16.67	3.7				
	4Q	16.55	16.75	1.2				
	1Q	17.40	16.70	4.1				
Co-located Sampler	2Q	17.29	16.67	3.6	2.48	1.9	8.39	0.98
	3Q	16.75	16.67	0.5				
	4Q	16.88	16.67	1.3				
	1Q	17.46	16.67	4.6				

3.0 MONITORING DATA NETWORK SUMMARY

3.1 Air Quality Data Summary

A table summarizing the concentration of PM_{10} (micrograms per standard cubic meter [µg/m³]) measured at the monitoring station from April 1, 2004 through March 31, 2005 is included as Table 3-1. A graphical representation of recorded PM_{10} collected is presented as Figure 3-1.

The annual average PM_{10} concentration for the main sampler was 5.14 µg/m^3 and for the co-located sampler was 6.06 µg/m^3. These measured annual averages are in compliance with the maximum annual average concentration of 50 µg/m^3 as set forth in 18 Alaska Administrative Code (AAC) 50.010 and presented in Table 3-4. The AAAQS 24-hour average of 150 µg/m^3 was not exceeded during the monitoring period.

Table 3-1
AAAQS Ambient Air Monitoring Table

Date	Average		1st High Value		2nd High Value		AAAQS Exceedances
	Main (µg/m^3)	Co-located (µg/m^3)	Main (µg/m^3)	Co-located (µg/m^3)	Main (µg/m^3)	Co-located (µg/m^3)	
2nd Quarter	4	4	12	8	10	7	150 µg/m$_3$
% of AAAQS	*2.7%*	*2.7%*	*8.0%*	*5.3%*	*6.6%*	*4.6%*	
3rd Quarter	8	12	75	77	18	19	
% of AAAQS	*5.3%*	*8.0%*	*50%*	*51.3%*	*12.0%*	*12.6%*	
4th Quarter	4	4	9	8	8	7	
% of AAAQS	*2.7%*	*2.7%*	*6.0%*	*5.3%*	*5.3%*	*4.6%*	
1st Quarter	4	5	9	9	7	6	
% of AAAQS	*2.7%*	*3.3%*	*6.0%*	*6.0%*	*4.6%*	*4.0%*	
Annual	5	6	n/a	n/a	n/a	n/a	50 µg/m$_3$
% of AAAQS	*10%*	*12%*					

3.2 Meteorological Data Summary

Not applicable.

4.0 REFERENCES

Hoefler Consulting Group, Inc., 2003*. Quality Assurance Project Plan for the Rock Creek Ambient and Meteorological Monitoring Project.* Anchorage, AK.

U.S. Environmental Protection Agency, 1987. *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD).* U.S. EPA OAQPS. Research Triangle Park, NC. EPA-450/4-87-007.

Appendix A

Data Processing Specifications and Statistical Formulae

A.1 Data Recovery Percentage

This section lists calculations used to determine percent data recovery. Data recovery percentage is calculated assuming a minimum of 80% valid 24-hour samples per quarter.

Quarterly Data Completeness (DC_1) for PM_{10} monitoring was determined using the following formula:

$$DC_1 = h_v/h_i \times 100$$

Where: h_v = number of hours of valid data
h_i = total possible number of hours for the monitoring period

Table A-1 shows percent data recovery for the project monitoring period.

Table A-1
Data Recovery Percentage

PM_{10}			
Period	**Main**	**Co-located**	**Both**
2nd Quarter 2004	76.7%	86.7%	83.3%
3rd Quarter 2004	83.9%	87.5%	87.1%
4th Quarter 2004	93.3%	80.0%	93.3%
1st Quarter 2005	90.0%	66.7%	90.0%
YTD[3]	**86.0%**	**80.3%**	**90.1%**

A.2 Data Bias Correction Using Calibration Information

Not applicable.

A.3 Estimation of Pasquill-Gifford Stability Categories

Not applicable.

[3] For the purposes of this report, the annual reporting period will be from April 1, 2004 to March 31, 2005.

APPENDIX B

Precision Data

Table B-1
Replicate Sample Measurements: Pre-Exposed Samples

Sample ID	Pre-Exposed Mass (mg)	Audit Mass (mg)	Difference	Audit Specification
2nd Quarter				
406040	81.147	81.148	-0.001	0.028
406160	84.095	84.097	-0.002	0.028
406170	83.204	83.200	0.004	0.028
406610	82.822	82.813	0.009	0.028
406616	79.104	79.102	0.002	0.028
406891	89.524	89.529	-0.005	0.028
406882	91.924	91.925	-0.001	0.028
Quarterly Average Difference			0.001	0.028
3rd Quarter				
407045	91.166	91.173	-0.007	0.028
407035	92.848	92.856	-0.008	0.028
407355	85.185	85.194	-0.009	0.028
407620	89.596	89.598	-0.002	0.028
Quarterly Average Difference			-0.006	0.028
4th Quarter				
407865	82.060	82.060	0.000	0.028
407855	81.462	81.468	-0.006	0.028
407345	89.638	89.642	-0.004	0.028
407610	89.409	89.414	-0.005	0.028
408285	92.669	92.679	-0.010	0.028
Quarterly Average Difference			-0.005	0.028
1st Quarter				
408085	90.562	90.565	-0.003	0.028
408505	89.660	89.669	-0.009	0.028
408985	90.101	90.099	0.002	0.028
409185	82.151	82.166	-0.015	0.028
Quarterly Average Difference			-0.006	0.028

Table B-2
Replicate Sample Measurements: Post-Exposed Samples

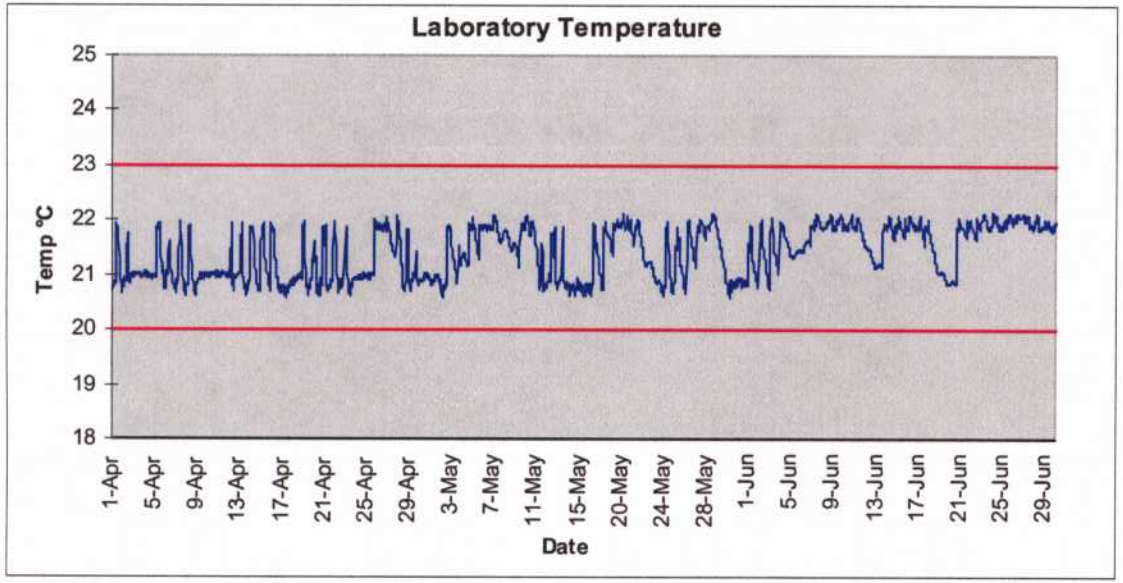
Sample ID	Post-Exposed Mass (mg)	Audit Mass (mg)	Difference	Audit Specification
2nd Quarter				
406034	81.806	81.805	0.001	0.050
406158	81.313	81.312	0.001	0.050
406166	83.154	83.154	0.000	0.050
406610	83.088	83.100	-0.012	0.050
406613	81.277	81.283	-0.006	0.050
406880	92.466	92.456	0.010	0.050
406882	91.983	91.984	-0.001	0.050
Quarterly Average Difference			-0.001	0.050
3rd Quarter				
406884	83.333	83.327	0.006	0.050
406887	93.008	93.007	0.001	0.050
407049	94.029	94.038	-0.009	0.050
407356	88.560	88.560	0.000	0.050
407357	87.395	87.394	0.001	0.050
407349	84.824	94.830	-0.006	0.050
407343	91.475	91.481	-0.006	0.050
407344	84.822	84.825	-0.003	0.050
Quarterly Average Difference			-0.002	0.050
4th Quarter				
407623	90.487	90.488	-0.001	0.050
407611	90.531	90.532	-0.001	0.050
407613	89.700	89.710	-0.010	0.050
Quarterly Average Difference			-0.004	0.050
1st Quarter				
408082	90.667	90.667	0.000	0.050
408993	91.671	91.671	0.000	0.050
409184	80.596	80.601	-0.005	0.050
Quarterly Average Difference			-0.002	0.050

Table B-3
Field Blank Samples

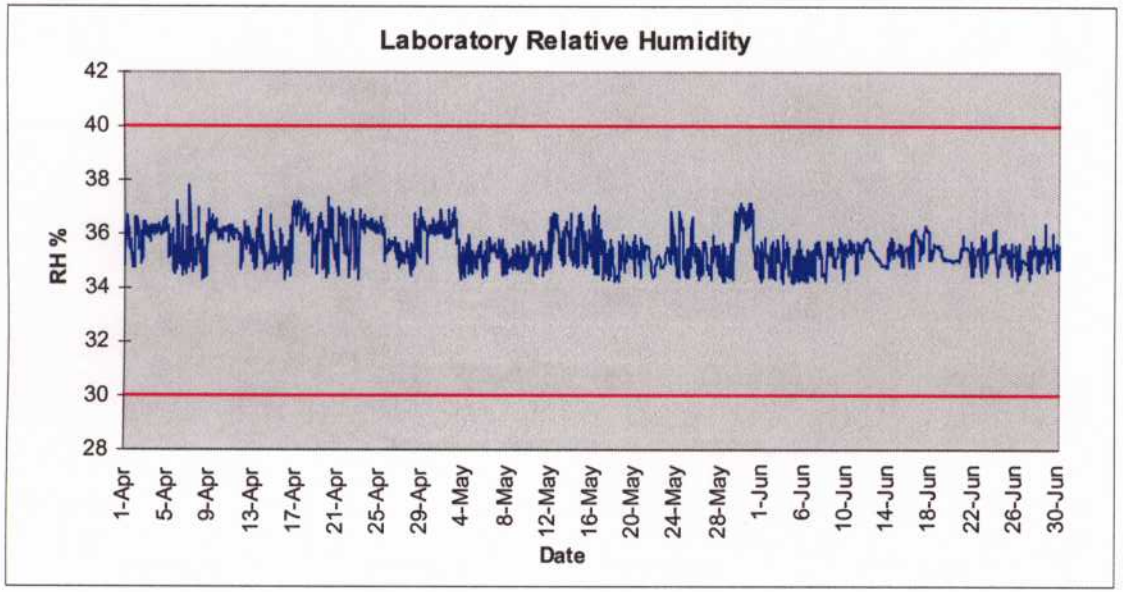
Date	Sample ID	Pre-Filter Weight (mg)	Post-Filter Weight (mg)	Difference
2nd Quarter				
4/5/04	406036	81.390	81.415	0.025
4/15/04	406161	83.226	83.283	0.057
5/21/04	406614	80.068	80.080	0.012
6/18/04	406883	83.405	83.405	0.045
Quarterly Average Difference				**0.035**
3rd Quarter				
7/15/04	407045	91.166	91.187	0.021
8/20/04	407354	82.814	82.853	0.039
9/16/04	407341	90.739	90.805	0.066
Quarterly Average Difference				**0.042**
4th Quarter				
10/21/04	407852	82.370	82.385	0.015
11/18/04	407606	89.685	89.734	0.049
12/13/04	408501	88.943	88.977	0.034
Quarterly Average Difference				**0.033**
1st Quarter				
1/15/05	408078	92.037	92.094	0.057
2/25/05	408985	90.101	90.121	0.020
3/18/05	409192	84.575	84.630	0.055
Quarterly Average Difference				**0.044**

Figures B-1 through B-4
Filter Conditioning Environment

04/01/04 - 06/30/04

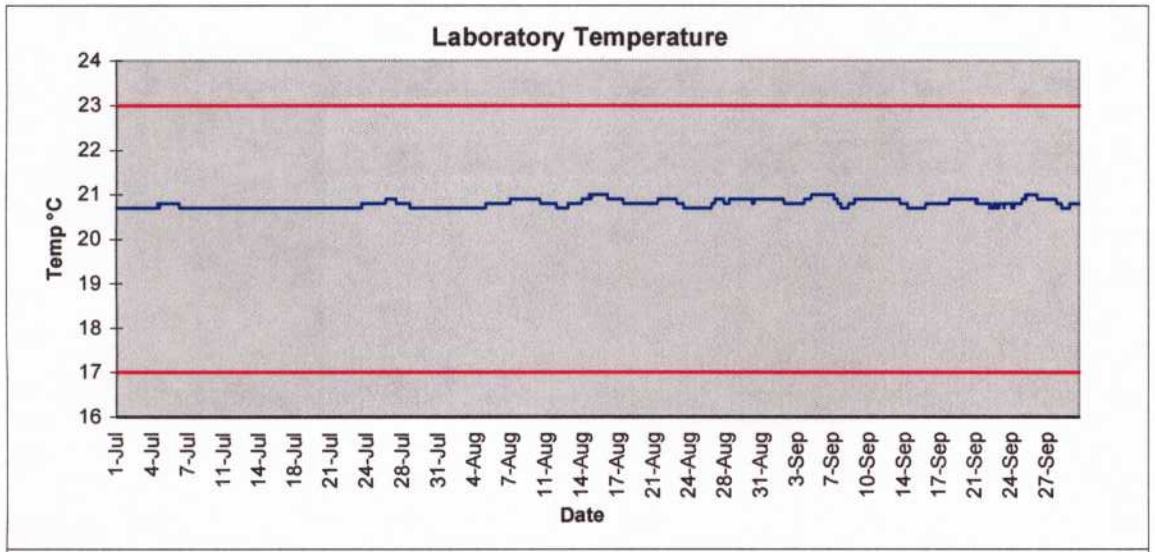


Temperature	
Mean	21.4
Standard Deviation	0.14
Maximum	22.3
Minimum	20.5

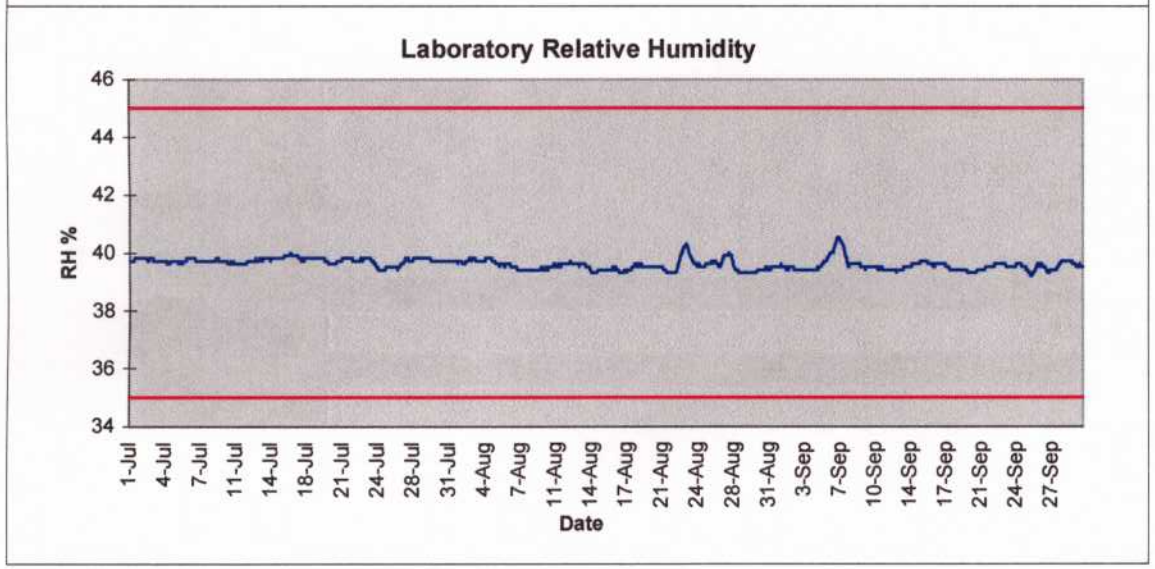


Relative Humidity	
Mean	35.5
Standard Deviation	0.52
Maximum	38.9
Minimum	33.7

07/01/04 - 09/30/04

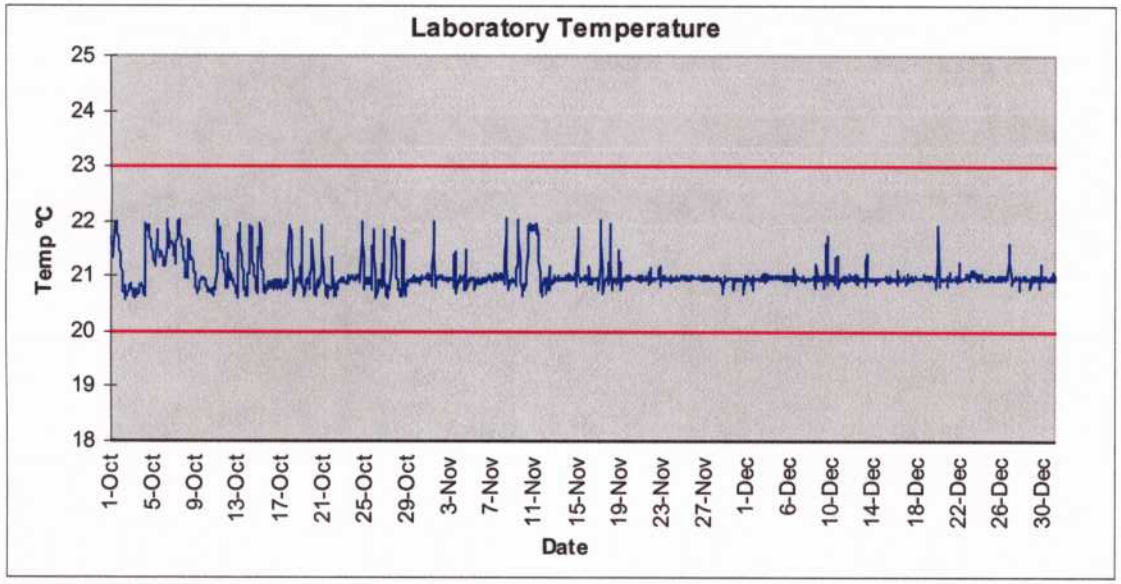


Temperature	
Mean	20.8
Standard Deviation	0.34
Maximum	21.0
Minimum	20.7

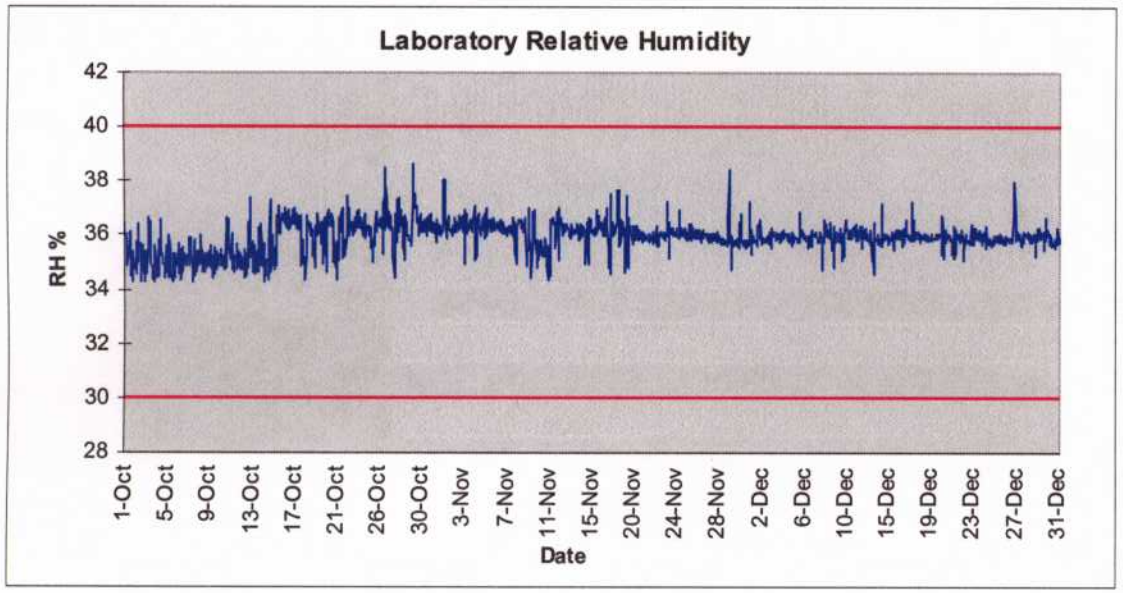


Relative Humidity	
Mean	39.6
Standard Deviation	0.50
Maximum	40.5
Minimum	39.2

10/01/04 - 12/31/04

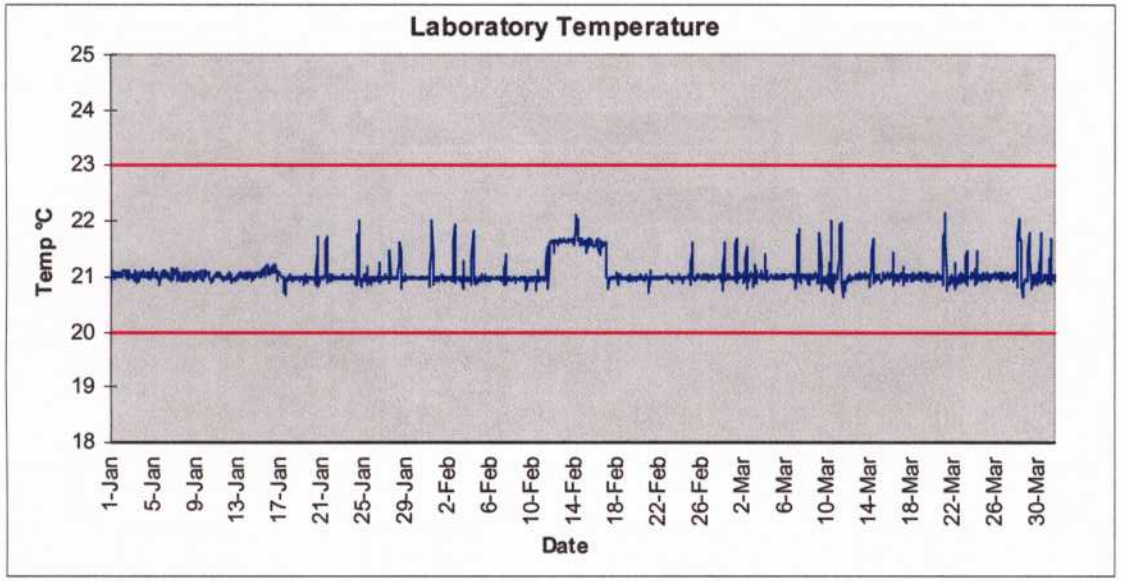


Temperature	
Mean	21.0
Standard Deviation	0.22
Maximum	22.2
Minimum	20.5

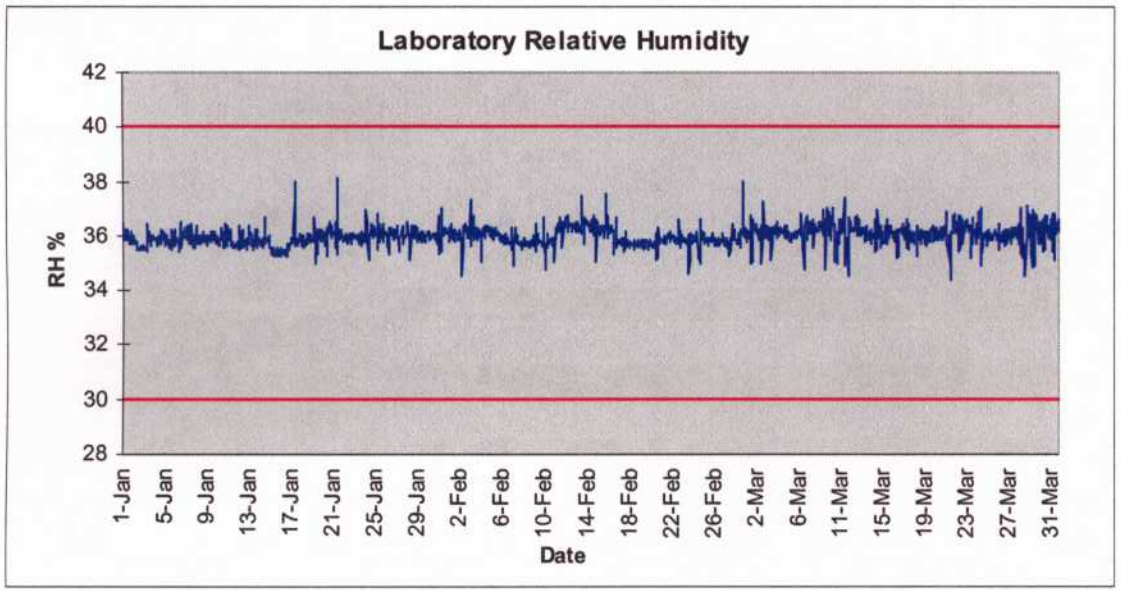


Relative Humidity	
Mean	35.9
Standard Deviation	0.72
Maximum	39.4
Minimum	33.7

01/01/05 - 03/31/05



Temperature	
Mean	21.1
Standard Deviation	0.29
Maximum	22.5
Minimum	20.2



Relative Humidity	
Mean	36.0
Standard Deviation	0.94
Maximum	40.0
Minimum	32.7

Table B-4
Quarterly Precision Data for Co-located Particulate Samplers

Period	Main ($\mu g/m^3$)	Co-located ($\mu g/m^3$)	% Difference	Average % Difference	Standard Deviation	Upper 95% Limit	Lower 95% Limit
2nd Quarter							
4/3/04	invalid	invalid	-	0.55	58.0	80.9	-79.8
4/9/04	2	3	40				
4/15/04	5	5	0				
4/21/04	3	2	-40				
4/27/04	12	invalid	-				
5/3/04	6	1	-143				
5/9/04	3	8	91				
5/15/04	2	2	0				
5/21/04	3	3	0				
5/27/04	invalid	1	-				
6/2/04	3	4	29				
6/8/04	6	8	29				
6/14/04	invalid	5	-				
6/20/04	7	7	0				
6/26/04	2	2	0				
3rd Quarter							
7/2/04	18	19	5	11.4	29.8	52.7	-30.0
7/8/04	4	5	22				
7/14/04	5	5	0				
7/20/04	5	5	0				
7/26/04	11	11	0				
8/1/04	5	5	0				
8/7/04	4	4	0				
8/13/04	2	5	86				
8/19/04	12	invalid	-				
8/25/04	75	77	3				
8/31/04	invalid	invalid	-				
9/6/04	5	4	-22				
9/12/04	invalid	6	-				
9/18/04	9	7	-25				
9/24/04	3	4	29				
9/30/04	3	5	50				

Table B-4 (continued)
Quarterly Precision Data for Co-located Particulate Samplers

Period	Main ($\mu g/m^3$)	Co-located ($\mu g/m^3$)	% Difference	Average % Difference	Standard Deviation	Upper 95% Limit	Lower 95% Limit
4th Quarter							
10/6/04	2	invalid	-	12.2	32.1	56.6	-32.3
10/12/04	2	2	0				
10/18/04	7	8	13				
10/24/04	3	3	0				
10/30/04	4	5	22				
11/5/04	3	3	0				
11/11/04	2	2	0				
11/17/04	6	invalid	-				
11/23/04	3	invalid	-				
11/29/04	4	4	0				
12/5/04	1	3	100				
12/11/04	2	3	40				
12/17/04	3	3	0				
12/23/04	7	7	0				
12/29/04	4	3	-29				
1st Quarter							
1/16/05	7	invalid	-	2.9	44.4	64.4	-58.6
1/22/05	4	2	-67				
1/28/05	9	9	0				
2/3/05	7	6	-15				
2/9/05	3	9	100				
2/16/05	invalid	invalid	-				
2/21/05	2	2	0				
2/27/05	invalid	invalid	-				
3/5/05	2	3	40				
3/11/05	4	3	-29				
3/17/05	6	5	-18				
3/23/05	5	6	18				
3/29/05	4	4	0				

APPENDIX C

Accuracy Data

Table C-1
Field Calibration Data

Date	Primary		Co-located	
	% Difference "As Found"	% Difference "As Left"	% Difference "As Found"	% Difference "As Left"
4/7/04	14.1	0.0	12.5	-0.1
4/17/04	-3.7	-0.1	-1.9	0.0
5/1/04	4.7	0.0	3.2	0.0
5/7/04	-4.2	0.0	-3.9	0.0
5/13/04	-0.1	-	0.7	0.0
5/22/04	-2.5	0.0	0.1	-
5/28/04	2.6	0.0	-2.2	-0.1
6/3/04	4.6	0.0	5.3	0.0
6/9/04	6.2	0.0	-0.5	0.0
6/18/04	5.6	0.0	-2.0	0.0
6/30/04	6.6	-0.05	10.3	0.0
7/9/04	0.05	-	-1.7	0.0
7/15/04	2.0	0.0	7.8	0.0
7/24/04	-2.4	-0.05	9.9	0.0
7/30/04	5.7	0.0	2.0	0.0
8/14/04	-6.1	0.0	0.0	-
8/20/04	6.7	0.0	9.7	-0.05
8/26/04	8.0	0.0	2.7	0.05
9/1/04	14.4	0.0	-12.7	0.0
9/10/04	1.8	0.1	0.0	-
9/16/04	15.0	0.0	5.1	0.0
10/1/04	-9.1	0.0	-1.9	-0.2
10/7/04	7.0	-0.1	9.8	-0.1
10/22/04	-11.3	0.1	0.0	0.0
11/12/04	-4.9	0.0	1.2	0.1
11/24/04	1.01	0.1	1.8	-0.1
12/13/04	9.3	0.0	8.9	0.0
12/28/04	-6.5	0.0	-2.9	-2.9
1/17/05	0.5	-	-	-
1/26/05	9.4	0.11	5.0	-0.2
2/4/05	-2.6	-0.11	0.11	-
2/19/05	8.7	-	-0.1	-
3/6/05	9.3	0.5	12.6	0.0
3/15/05	-0.4	0.0	-3.9	0.0
3/24/05	7.9	-0.05	11.0	-0.2

APPENDIX D

Validated Manual Particulate Data

Table D-1
Validated Field Particulate Data
(Includes all valid data collected from 1Q04 through 1Q05)

Date	Primary	Co-Located
1st Quarter		
1/10/2004	5	5
1/13/2004	4	-
1/22/2004	4	3
1/25/2004	4	-
1/28/2004	6	5
2/18/2004	3	-
2/21/2004	2	1
2/24/2004	4	-
3/7/2004	1	-
3/10/2004	3	3
3/13/2004	2	-
3/16/2004	2	2
3/19/2004	4	-
3/22/2004	2	2
3/25/2004	3	-
3/28/2004	7	7
2nd Quarter		
4/9/2004	2	3
4/15/2004	5	5
4/18/2004	4	-
4/21/2004	3	2
4/24/2004	4	-
4/30/2004	4	-
5/3/2004	6	1
5/9/2004	3	8
5/12/2004	3	-
5/15/2004	2	2
5/18/2004	10	-
5/21/2004	3	3
5/24/2004	0	-
5/30/2004	3	-
6/2/2004	3	4
6/5/2004	2	-
6/8/2004	6	8
6/17/2004	2	-
6/20/2004	7	7
6/23/2004	4	-
6/26/2004	2	2
6/29/2004	6	-

Date	Primary	Co-Located
3rd Quarter		
7/2/2004	18	19
7/5/2004	4	-
7/8/2004	4	5
7/11/2004	10	-
7/14/2004	5	5
7/17/2004	4	-
7/20/2004	5	5
7/23/2004	5	-
7/26/2004	11	11
7/29/2004	3	-
8/1/2004	5	5
8/4/2004	5	-
8/7/2004	4	4
8/10/2004	5	-
8/13/2004	2	5
8/16/2004	4	-
8/25/2004	75	77
9/3/2004	4	-
9/6/2004	5	4
9/9/2004	6	-
9/18/2004	9	7
9/21/2004	5	-
9/24/2004	3	4
9/27/2004	3	-
9/30/2004	3	5
4th Quarter		
10/3/2004	2	-
10/9/2004	1	-
10/12/2004	2	2
10/15/2004	7	-
10/18/2004	7	8
10/21/2004	5	-
10/24/2004	3	3
10/27/2004	3	-
10/30/2004	4	5
11/2/2004	2	-
11/5/2004	3	3
11/8/2004	4	-
11/11/2004	2	2
11/14/2004	3	-
11/20/2004	9	-
11/26/2004	2	-
11/29/2004	4	4
12/2/2004	2	-
12/5/2004	1	3
12/11/2004	2	3
12/14/2004	3	-
12/17/2004	3	3
12/20/2004	8	-
12/23/2004	7	7
12/29/2004	4	3

Date	Primary	Co-Located
1st Quarter		
1/1/2005	0	-
1/4/2005	7	-
1/7/2005	3	-
1/10/2005	7	-
1/13/2005	5	-
1/19/2005	4	-
1/22/2005	4	2
1/25/2005	3	-
1/28/2005	9	9
1/31/2005	?	-
2/3/2005	7	6
2/6/2005	7	-
2/9/2005	3	9
2/12/2005	3	-
2/18/2005	3	-
2/21/2005	2	2
2/24/2005	3	-
3/2/2005	2	-
3/5/2005	2	3
3/8/2005	3	-
3/11/2005	4	3
3/14/2005	4	-
3/17/2005	6	5
3/20/2005	4	-
3/23/2005	5	6
3/26/2005	4	-
3/29/2005	4	4

APPENDIX E

Quality Assurance Audit Reports

Rock Creek Ambient Air and Meteorological Monitoring Station Performance Audit – Second Quarter 2004

for the

Rock Creek Project

Nome, Alaska

prepared for

Alaska Gold Company

August 2004

Second Quarter 2004 Audit Report

for the

Rock Creek Ambient Air and Meteorological Monitoring Project

Nome, Alaska

August 2004

prepared for

Alaska Gold Company

prepared by

Hoefler Consulting Group
3401 Minnesota Drive, Suite 300
Anchorage, Alaska 99503
907-563-2137

CONTENTS

APPENDICES

LIST OF TABLES

1.0 INTRODUCTION

Hoefler Consulting Group currently operates a meteorological and air monitoring station on behalf of Alaska Gold Company at the Rock Creek Mine Development Site, 7 miles north of Nome, Alaska at 64° 37' N latitude and 165° 26' W longitude. The location of the station is shown in Figure 1-1.

The station is made up of a 12-meter tower equipped with meteorological sensors and two particulate matter samplers. The meteorological monitoring tower meets the requirements of the Prevention of Significant Deterioration (PSD) program administered by the Alaska Department of Environmental Conservation (ADEC).

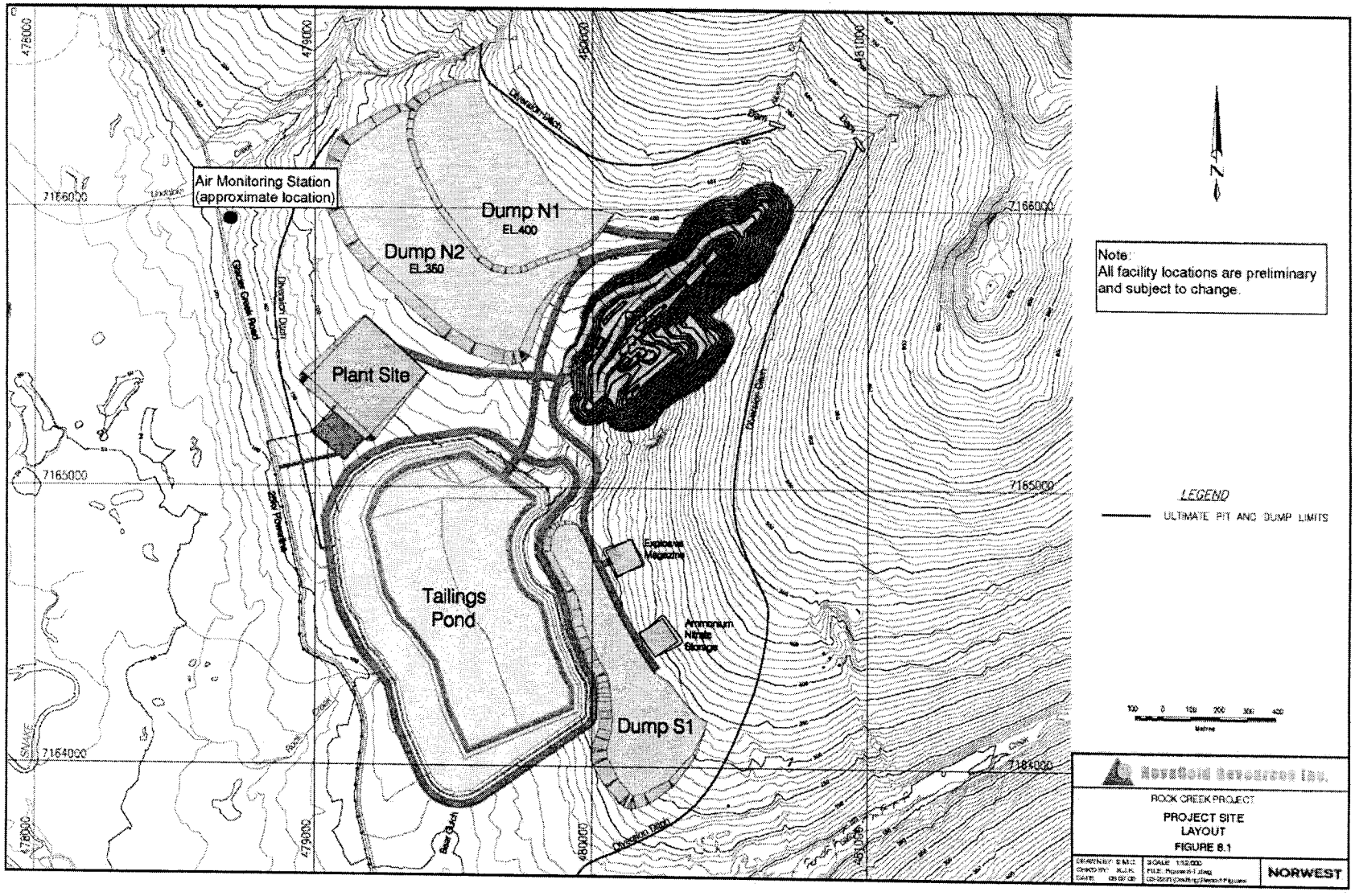
The two BGI PQ100 samplers measure the ambient concentration of aerosols with an effective aerodynamic diameter of 10 μm or less (PM_{10}). The meteorological sensors measure the following parameters:

- Wind Speed: Climatronics Model F460 3-cup anemometer with Lexan cups
- Wind Direction: Climatronics Model F460 wind vane
- Temperature and ΔT: Met One 062MP thermometers (at 2 and 10 meters)
- Relative Humidity: Vaisala HMP45AC Relative Humidity Probe
- Barometric Pressure: Vaisala PTB101B Barometer

The anemometer and wind vane are attached to the top of the tower on a crossarm, the thermistors are mounted at 2 meters inside of an RM Young motor-aspirated radiation shield. The collected data are stored onsite in a Campbell CR10X Data Acquisition System (DAS). The station is powered by solar panels and a thermal electric generator connected to deep cycle 12V lead acid batteries. The DAS is accessed for data retrieval and programming either in the field with a PC or through the cellular phone attached to the DAS.

This document reports the results of the audit of the station conducted on May 27 & 28, 2004. This report has been prepared for Alaska Gold as a step towards demonstrating that the meteorological data collected by the station meets the applicable PSD requirements as set forth by the U.S. Environmental Protection Agency (EPA).

Figure 1-1. Map of the Rock Creek Development and Surrounding Area



2.0 PERFORMANCE AUDIT

A performance audit was conducted on all required parameters measured by the station. Data sheets from the performance audit can be found in Appendix A.

2.1 Performance Audit Methodology

During the performance audit, the output of each meteorological sensor was read with a CR10X portable keyboard display. The results given by each meteorological sensor were compared to the results given by the calibrated audit instruments. The differences between the station and the audit instruments were compared with established PSD limits to determine the accuracy of each sensor. Threshold torques for wind speed and direction were manually measured and compared with established PSD limits. Table 2-1 summarizes the audit methods and limits used to verify each parameter.

Table 2-1. Performance Audit Methods and Acceptable Limits

Parameter	Audit Method	PSD Limit
DAS Time	NOAA Clock	≤± 5 minutes from AST
Wind Direction Alignment	GPS	≤± 5° from true bearing per point
Wind Direction Accuracy	Linearity tester and cross-arm square	≤± 5° per audit point
Wind Direction Linearity		≤3° mean absolute average
Wind Direction Torque	Torque watch	≤0.104 oz-in (11 g-cm)
Wind Speed Accuracy	Synchronous motor	≤± 0.2 m/s ±5% observed
Wind Speed Torque	Torque watch	≤1.0 g-cm
Temperature Accuracy	NIST thermometer	≤± 0.5°C
Temperature Difference (ΔT)	Co-location of 2- and 10-meter thermometers	≤± 0.1°C
Humidity (as dew point)	NIST RH Probe	± 1.5°C
Barometric Pressure	NIST Barometer	≤± 3 mb

2.1.1 Data Acquisition System

An audit of the DAS was conducted by comparing of all DAS outputs to the audit standards, as described below. The DAS time was checked against an instantaneous time reading from the National Oceanic and Atmospheric Administration (NOAA) clock in Boulder, Colorado via a global position system (GPS).

2.1.2 Temperature

The two air temperature thermometers (2-meter and 10-meter) were audited against a National Institute of Standards and Technology (NIST) traceable digital thermometer to determine system accuracy. The 2- and 10-meter thermometers' readings were compared to the NIST traceable digital thermometers and to each other in an ice/water bath and water baths of varying temperatures.

2.1.3 Wind Direction

The wind direction sensor was audited "as-found" to determine the accuracy of the alignment with respect to true north (true azimuth alignment) using a GPS handheld unit. A Garmin GPS 12 CX model was used to estimate the position of the auditor with respect to the tower. Initially, a waypoint is marked into the GPS at the tower's position. Next, using binoculars, the tail of the wind vane is aligned with the auditor's position at a distance of several hundred feet from the tower. In reference to the aligned wind vane, the auditor's bearing on the GPS with respect to the waypoint marking the tower's position provides the true direction of the wind vane. The GPS-derived direction is then compared with the output from the DAS to calculate a percent difference.

After the completion of the "as-found" audit, the wind instruments were removed from the tower, and further tests were preformed. Wind direction linearity and accuracy were determined by mounting the wind vane on a Climatronics linearity check wheel and comparing the DAS output with the actual orientation of the vane in 30° increments.

The wind direction threshold value was tested using a Waters torque watch to measure wind vane torque. The highest torque required to turn the wind vane was compared to the established limits.

The wind vane sensor was placed back on the tower after all necessary audits were completed. A final "as-left" audit was conducted on the alignment of the sensor, identical to the "as-found" audit carried out prior to removing the sensor from the tower.

2.1.4 Wind Speed

The anemometer was audited to determine relative accuracy for wind speed and sensor torque threshold. First, the spinning shaft of the anemometer was rotated at several different known rates by an attached variable-speed RM Young synchronous motor. Each rate of revolution is equivalent to a speed, the relationship being given by the manufacturer's anemometer

calibration formulas (Appendix B). The equivalent speed of the synchronous motor was compared with the instrument output.

Next, a Waters torque watch was attached to the spinning shaft of the anemometer. Several torque readings were made within different quadrants along the axis of rotation of the shaft. The maximum reading was recorded for the threshold of force required to turn the spinning shaft of the anemometer.

2.1.5 Humidity

The station humidity probe's temperature and relative humidity readings at ambient conditions were converted to a dew point and compared to dew point indicated by a NIST traceable humidity probe.

2.1.6 Barometric Pressure

The station barometer reading was compared at ambient conditions to the reading from a NIST traceable digital barometer.

2.1.7 PM_{10} Sampler Flow Rate

The sampler flow rates were measured by a NIST traceable flow transfer standard (FTS).

2.2 Performance Audit Results

JR Wilcox conducted the audit on May 27 & 28, 2004. Each sensor was challenged with certified audit equipment, and the starting torques of the anemometer and wind vane were tested. The sensors were tested for compliance with the PSD performance accuracy requirements and starting torque threshold limits. A summary of the performance audit results is provided in Table 2-2 for the met tower and in table 2-3 for the PM samplers.

After the 10-meter temperature was re-installed on the tower, it was discovered that the audit temperature sensor and probe had been due for calibration on 2/24/04. This created uncertainty about the accuracy of the 2-meter and 10-meter tests, but not about the ΔT since this parameter does not involve the audit thermometer. The 2-meter thermometer was removed and retested using the site calibrator's temperature sensor and probe. The results confirmed the accuracy of the 2-meter thermometer. Since the difference in temperature readings between the two site thermometers was previously established to be negligible, this result establishes the accuracy of the 10-meter thermometer as well.

Complete audit reports are provided in Appendix A. Certification sheets of audit instruments are provided in Appendix B. Manufacturer data sheets for the meteorological equipment that display wind speed calibration formulas and starting torques for wind direction and wind speed are provided in Appendix C.

Table 2-2. Met Tower Audit Summary

Parameter	PSD Limit	Error[1]	Pass/Fail
DAS Time (Min:Sec)	≤±5:00	4 sec	Pass
Wind Direction Alignment (as found)	≤±5°	4°	Pass
Wind Direction Alignment (as left)	≤±5°	4°	Pass
Wind Direction Torque[2]	≤0.104 oz-in	0.021	Pass
Wind Direction Accuracy	≤±5°	2.2°	Pass
Wind Direction Linearity	≤3°	0.8°	Pass
Wind Speed Accuracy	≤±0.2 m/s ±5%	0.00 m/s	Pass
Wind Speed Torque	≤0.0049 oz-in	< 0.003 oz-in	Pass
Temperature Accuracy (2-meter)	≤±0.5°C	0.09°C	Pass
Temperature Accuracy (10-meter)	≤±0.5°C	0.09°C	Pass
Temperature Difference (ΔT)	≤± 0.1°C	0.00°C	Pass
Humidity (as dew point)	± 1.5°C	0.5°C	Pass
Barometric Pressure	≤± 3 mb	1.03 mb	Pass

In order to be within recommended accuracy, the sampler flow rate as measured by a NIST-traceable FTS should be within 7% of the flow rate indicated by the sampler and 10% of the sampler's design flow rate (16.67 L/min). The audits were conducted under ambient conditions of 3.9°C and 994 mb.

Table 2-3. PM Sampler Audit Summary

Sampler	% Difference		Pass/Fail
	FTS vs. Indicated Flow	FTS vs. Design Flow	
Primary	4.7%	4.7%	Pass
Co-located	3.6%	3.6%	Pass

[1] When several readings were taken, the maximum error is reported.
[2] Torque measurement after replacement of the wind direction sensor.

3.0 COMMENTS AND RECOMMENDATIONS

- All met station sensor & PM_{10} sampler parameters passed their audits, with the exception of wind vane torque, which was marginally higher than the recommended value. The problem was traced to the wind vane potentiometer. A new wind direction sensor was shipped up from Anchorage the evening of the 27th and installed the morning of the 28th. An audit of the new sensor showed it to be well within tolerance for all parameters. The serial number of the original wind direction sensor was 4567, it was replaced with S/N 4007.

- On the 28th, Robbie O'Conner recovered the 5/27/2004 primary & collocated PM10 filter samples, cleaned the samplers, and set up the next sample runs. In conversations with Robbie he indicated that he was familiar and comfortable with the routing operation and maintenance of the samplers, and that things had been running smoothly for the last few months, after the initial startup difficulties.

4.0 REFERENCES

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Appendix A

Rock Creek Monitoring Program
Station Audit

Site: Rock Creek Met Station Nome, AK
Auditor: JR Wilcox
Date: 5/27/04

1. TIME CHECK

DAS Time: 11:30:56 AST
Actual Alaska Standard Time: 11:31:00 AST (12:31:00 ADT)
Difference Between Times: 4 seconds
Recommended Accuracy: ± 5 minutes

2. WIND DIRECTION

Wind Direction Calibration Start/Completion Time (AST): 11:00-19:00 5/27, 7:00-9:30 5/28

Wind Direction Sensor:
Make: Climatronics
Model: F460 #100076
S/N: 4567(vane #1398)

WD Calibration Instruments:
Make: Climatronics WD Linearity Test Jig
Model: 101986
S/N: 145

Make: Garmin
Model: GPS
S/N:

WIND VANE ALIGNMENT AS FOUND

	GPS Reading (°)	DAS Reading (°)	Difference (°)
Point 1 (tail)	324	326	+2
Point 2 (tail)	69	73	+4
Point 3 (tail)	116	120	+4
Point 4 (tail)	192	195	+3

Recommended Accuracy: ± 5° from landmark (alignment)

WIND VANE ALIGNMENT AS LEFT

	GPS Reading (°)	Error	
		DAS (°)	Difference (°)
Point 1 (tail)	0	1.0	$+1_{.0}$
Point 2 (tail)	42	41.2	$-0_{.8}$
Point 3 (tail)	124	127.6	$+3_{.6}$
Point 4 (tail)	253	254.0	$+1_{.0}$

Recommended Accuracy: ± 5° from landmark (alignment)

Rock Creek Monitoring Program
Station Audit

Site: Rock Creek Met Station Nome, AK
Auditor: JR Wilcox
Date: 5/27/04

WIND DIRECTION TORQUE

Starting Torque: 0.12 oz-in

Just over recommended manufacturer tolerance, replaced wind direction sensor S/N 4567 with S/N 4007, (kept same vane) on 5/28/04.

Final Torque: 0.021 oz-in

Recommended Accuracy: Starting torque of 0.104 oz-in (Climatronics model F460)

WIND DIRECTION LINEARITY

Wind Vane Position (°)	DAS Output (°)	Error (°)	Wind Vane Position (°)	DAS Output (°)	Error (°)
30	29.5	0.5	210	210.2	0.2
60	59.9	0.1	240	240.3	0.3
90	90.3	0.3	270	270.6	0.6
120	120.9	0.9	300	301.7	1.7
150	151.3	1.3	330	332.2	2.2
180	181.0	1.0	360	0.1	0.1
			Mean Absolute Error $\frac{\Sigma \lvert x \rvert}{n}$		0.8

Recommended Accuracy: $\pm$ 5° (accuracy) and $\leq$ 3° Mean Absolute Error (linearity)

Rock Creek Monitoring Program
Station Audit

Site: Rock Creek Met Station Nome, AK
Auditor: JR Wilcox
Date: 5/27/04

3. WIND SPEED

Anemometer Calibration Start/Completion Time (AST): 15:15 AST

Anemometer:
Make: Climatronics
Model: F460 #100075
S/N: 4839 (cupset #2000)

Calibration Instruments:
Make: RM Young
Model: Anemometer Drive
S/N:

Make: RM Young
Model:
S/N:

WIND SPEED LINEARITY

Synchronous Motor (rpm)	Synchronous Motor (m/s)	DAS (m/s)	Difference (m/s)	Error
0 rpm	0.22	0.22	0.00	0%
100 rpm	2.57	2.57	0.00	0%
200 rpm	4.92	4.92	0.00	0%
400 rpm	9.62	9.62	0.00	0%
800 rpm	19.02	19.02	0.00	0%
			Mean Absolute Error	0%

Recommended Accuracy: ± (0.2 m/s + 5% of observed speed), with a maximum error of 2.5 m/s

Transfer Function (rate of rotation to wind speed):
Climatronics F460 w/ HD-Alum cups m/s = ((rpm/42.55) + 0.22)

ANEMOMETER TORQUE
Starting Torque: <0.003 oz-in
Bearings Replaced? N/A
Final Torque: N/A
Recommended Accuracy: Starting torque of 0.0049 oz-in (Climatronics model F460)

Rock Creek Monitoring Program
Station Audit

Site: Rock Creek Met Station Nome, AK
Auditor: JR Wilcox
Date: 5/27/04

4. 2-METER AND 10-METER TEMPERATURE AND ΔT:

Temperature Audit Start/Completion Time (AST): 10:50/11:19 AST

Thermometers:

2-Meter Temperature
Make: Met One
Model: 062MP
S/N: C4537 ID1

10-Meter Temperature
Make: Met One
Model: 062MP
S/N: C4537 ID2

Temperature Calibration Instrument (NIST Traceable):

Make: Fisher Scientific Thermometer
Model:
S/N: 21164797
Calibration Date: 2/24/03

Make: NIST Traceable Probe
Model:
S/N: 221367383
Calibration Date: 2/24/03

2-METER THERMOMETER ACCURACY

Temperature	NIST Temperature (°C)	DAS Temperature (°C)	Error (°C)
Ice Bath	0.03	0.09	+0.06
Warm Water	10.93	10.84	-0.09
Hot Water	21.28	21.25	-0.03

Recommended Accuracy: ± 0.5°C

10-METER THERMOMETER ACCURACY

Temperature	NIST Temperature (°C)	DAS Temperature (°C)	Error (°C)
Ice Bath	0.03	0.09	+0.06
Warm Water	10.93	10.84	-0.09
Hot Water	21.28	21.25	-0.03

Recommended Accuracy: ± 0.5°C

TEMPERATURE DIFFERENCE (ΔT) ACCURACY

Temperature Point	NIST ΔT (°C)	DAS ΔT (°C)	Error (°C)
Ice Bath	0.00	0.00	0.00
Warm Water	0.00	0.00	0.00
Hot Water	0.00	0.00	0.00

Recommended Accuracy: ± 0.1°C

Note: After the 10-meter temperature was re-installed on the tower, it was discovered that the audit temperature sensor and probe had been due for calibration on 2/24/04. This created uncertainty about the accuracy of the 2-meter and 10-meter tests, but not about the ΔT since this parameter does not involve the audit thermometer.

The 2-meter thermometer was removed and retested using the site calibrator's temperature sensor

Rock Creek Monitoring Program
Station Audit

Site: Rock Creek Met Station Nome, AK
Auditor: JR Wilcox
Date: 5/27/04

and probe. The results confirmed the accuracy of the 2-meter thermometer. Since the difference in temperature redreadings between the two site thermometers was previously established to be negligible, this result establishes the accuracy of the 10-meter thermometer as well.

Temperature Calibration Instrument (NIST Traceable):

Make: Fisher Scientific Thermometer
Model:
S/N: 285299
Calibration Date: 2/9/05

Make: NIST Traceable Probe
Model:
S/N: 230006464
Calibration Date: 1/22/05

2-METER TEMPERATURE SENSOR RE-CHECK

Temperature	NIST Temperature (°C)	DAS Temperature (°C)	Error (°C)
Ice bath	0.1	0.18	0.08
Cool water	6.3	6.32	0.02
Warm water	15.4	15.44	0.04
Hot water	32.7	32.66	0.04

Recommended Accuracy: ± 0.5°C

5. RELATIVE HUMIDITY

Relative Humidity Audit Start/Completion Time (AST): 12:00

Relative Humidity Sensor
Make: Vaisala
Model: HMP45AC
S/N: Y3940088

Relative Humidity Audit Instruments

Make: Vaisala
Model: HMI41
S/N: X0650080 (indicator)
Calibration Due: 7/11/04

Make: Vaisala
Model: HMP41
S/N: X0740015 (probe)
Calibration Due: 7/11/04

NIST Temp (°C)	NIST RH (%)	NIST Dew Point (°C)	DAS RH (%)	DAS Dew Point (°C)	Dew Point Error (°C)
6.9	67.3	1.3	65.3	0.8	0.5

Recommended Accuracy: ± 1.5 °C of dew point temperature

Rock Creek Monitoring Program
Station Audit

Site: Rock Creek Met Station Nome, AK
Auditor: JR Wilcox
Date: 5/27/04

6. BAROMETRIC PRESSURE

Barometric Pressure Sensor:
Make: Vaisala
Model: PTB101B
S/N: Y213007

Barometric Pressure Audit Instruments
Make: Pretel
Model: Alti Plus
S/N: 27806
Calibration Due: 4/17/04

Audit Probe (in Hg)	Audit Probe (mb)	DAS (mb)	Difference (mb)
29.34	993.57	994.60	1.03

Recommended Accuracy: ± 3 mb

Comments:

PM_{10} Sampler Audit Data Sheet

Rock Creek Air Monitoring Project

Operator JR Wilcox Date/Time of Audit 5/28/04 9:30 ADT

PM_{10} Sampler: Make/Model BGI PQ100 S/N 374

Type of sampler (circle one): Primary Co-located

Flow Check Device Bios S/N 6402 Calibration Date 11/25/03

Ambient Temp 3.9 °C Ambient Press 29.34 inHg ~~mb~~

Flow Transfer Standard Flow Rate	17.46 L/min
Sampler Indicated Flow Rate	16.67 L/min
Sampler Design Flow Rate	16.67 L/min

% Difference of Sampler from Transfer Standard QC Flow Rate	4.7 %
% Difference of Transfer Standard Flow Rate from Design Flow Rate	4.7 %

Comments:

PM_{10} Sampler Audit Data Sheet

Rock Creek Air Monitoring Project

Operator JR Wilcox Date/Time of Audit 5/28/04 9:50 MDT

PM_{10} Sampler: Make/Model BGI PQ100 S/N 373

Type of sampler (circle one): Primary (Co-located)

Flow Check Device BGI S/N 6402 Calibration Date 11/25/03

Ambient Temp 3.9 °C Ambient Press 29.34 ~~mb~~ in Hg

Flow Transfer Standard Flow Rate	17.27 L/min
Sampler Indicated Flow Rate	16.67 L/min
Sampler Design Flow Rate	16.67 L/min

% Difference of Sampler from Transfer Standard QC Flow Rate	3.6 %
% Difference of Transfer Standard Flow Rate from Design Flow Rate	3.6 %

Comments:

Appendix B

Calibration complies with ISO 17025

Cert. No. 4001: 432778

Traceable® Certificate of Calibration for Temperature Probe

Instrument Identification

Model No.61220-604 S/N 230006463 Manufacturer:Control Company

Standards Used	Model	Serial No.	Recall Date	NIST Reference
Thermometrics Temp Probe	ES225	128	6/26/2004	A3617063
Hart Scientific 2563 Module	2563	A27129	7/22/2004	1000153920
Hart Precision Bath	7011	93139		

Certificate Information

As Found: In Tolerance Cal Date: 1/23/2004

As Left: In Tolerance Due Date: 1/22/2005

Procedure: CAL-03 Technician: 68

Test Conditions: 24.5°C 38.0 RH 30 in Hg

Calibration Data (As Left)

Standard	Reading	Units	Condition
25.001	25.0	°C	In Tolerance

Accuracy: ±0.1°C
Expanded Measurement Uncertainty at k=2: ± 0.059°C

This Temperature Probe was calibrated against National Institute of Standards and Technology Traceable Instrumentation.
A Test Uncertainty Ratio of at least 8.2:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full.

Wallace Berry

Wallace Berry, Technical Manager

Maintaining Accuracy

In our opinion, once calibrated your Temperature Probe should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Temperature Probes change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 308 West Edgewood Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com

Audit 2

Calibration complies with ISO 17025

ACCREDITED Certificate No. 1750.01

Cert. No. 4000: 295045

Traceable® Certificate of Calibration for Digital Thermometer

Instrument Identification

Hoefler Consulting Group, 701 Sesame Street, Suite 200, Anchorage, AK 99503 U.S.A. (RMA:919567)

Model No.15-077-8 S/N 21164797 Manufacturer:Control Company

Probe: 15-077-7 221367383

Standards/Equipment Used	Model	Serial No.	Recall Date	NIST Reference
THERMOMETRICS TEMP PROBE	ES225	128	6/10/2003	A252127
HART SCIENTIFIC 2563 MODULE	2563	A27129	7/11/2003	A2711028
HART PRECISION BATH	7011	93139		

Certificate Information

As Found: Out of Tolerance Cal Date: 2/24/2003

As Left: In Tolerance Due Date: 2/24/2004

Procedure: CAL-06 Technician: 68

Test Conditions: 25.5°C 44.0 RH 30 in Hg

Calibration Data (As Left)

Standard	Reading	Units	Condition
0.001	0.001	°C	In Tolerance
24.998	25.000	°C	In Tolerance
60.005	60.001	°C	In Tolerance
99.999	99.994	°C	In Tolerance

Accuracy: ±0.05°C (0 to 100°C) otherwise 0.1°C
Expanded Measurement Uncertainty at k=2: ± 0.013°C

This Digital Thermometer was calibrated against National Institute of Standards and Technology Traceable Instrumentation.
A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full.

Wallace Berry

Wallace Berry, Technical Manager

Maintaining Accuracy

In our opinion, once calibrated your Digital Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 308 West Edgewood Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com

LOW RANGE TORQUE WATCH DIAL SETTINGS vs. OUTPUT OF LOW RANGE STANDARD

MODEL: 366-0 SERIAL NUMBER: 5042 Units = oz in Accuracy = 5 % FS

Set Dial To	Low Limit	CW Rdg	CCW Rdg	High Limit
.00	-.003	0.000	0.000	.003
.06	.030	.053	.056	.090
.12	.090	.113	.116	.150
.18	.150	.174	.176	.210
.24	.210	.237	.255	.270
.30	.270	.298	.291	.330
.36	.330	.356	.342	.390
.42	.390	.415	.414	.450
.48	.450	.478	.462	.510
.54	.510	.535	.544	.570
.60	.570	.595	.621	.630

Max pos error (% FS) = 3.4 % at .600
Max neg error (% FS) = -3.0 % at .480

Torque Watch is a: PASS

CERTIFICATE OF ACCURACY

REPORT # TW5680 CUSTOMER BUTLER AND LAND SALES ORDER 2487485-001

This is to certify that Honeywell Torque Watch Gauge, SN 5042 has been inspected to +/- 5% of full scale reading and found accurate.

The weight standards used for this calibration are traceable to NIST Report #822/254480. Calibration procedures are in compliance with ANSI/NCSL Z540-1-1994.

Test Equipment # GW151 Accuracy of Standard + 1% Calibration Procedure 76519-1 Rev. A

TORQUE WATCH GAUGE CALIBRATION CHART
HONEYWELL DATA INSTRUMENTS
100 DISCOVERY WAY
ACTON MA 01720
978-264-9550

MODEL 366-0 SERIAL NUMBER 5042 P.O. # 79383

CALIBRATED BY S.Z. DATE 11/5/2003 APPROVED Shirley Zink

TEMPERATURE 70 DEG F RELATIVE HUMIDITY % 35

CALIBRATION POINT IN Oz. In.	ACTUAL WATCH READING CW	CCW
SEE ATTACHED DATA		

TORQUE WATCH GAUGE WARRANTY

Each Torque Watch Gauge is designed, manufactured and scientifically tested in accordance with the highest standards of good engineering practice and is warranted by the manufacturer to be free of original defects of design, material, and workmanship. It is further warranted that, at the time of manufacture and test, each Torque Watch Gauge was within a specified accuracy tolerance. The liability of the manufacturer is limited to repairing or replacing, at its option, any defective Torque Watch Gauge, or part thereof, that is returned to the manufacturer's plant, transportation charges prepaid, within a period of ninety days from the date of original shipment.

The manufacturer maintains an adequate service facility to handle normal repairs and recalibration of Torque Watch Gauges. Routine repair and recalibration service, subsequent to the expiration of the warranty period, is handled on a flat rate basis per Gauge for Gauges that have not been damaged or abused through negligence and/or altered or repaired outside the manufacturer's plant.

Calibration complies with ISO 17025

Cert. No. 4000: 438066

Traceable® Certificate of Calibration for Digital Thermometer

Instrument Identification

Model No.61220-601 S/N 285299 Manufacturer:Control Company

Standards Used	Model	Serial No.	Recall Date	NIST Reference
Thermistor Simulation Standard	CC001	98179306	10/8/2004	1000158493

Certificate Information

As Found: In Tolerance
As Left: In Tolerance
Procedure: CAL-4000A

Cal Date: 2/10/2004
Due Date: 2/9/2005
Technician: 76

Test Conditions: 23.0°C 52.0 RH 30 in Hg

Calibration Data (As Left)

Standard	Reading	Units	Condition
5	4.9	°C	In Tolerance
25	24.9	°C	In Tolerance
45	45.1	°C	In Tolerance
100	100.1	°C	In Tolerance

Accuracy: ±0.2°C
Expanded Measurement Uncertainty at k=2: ± 0.059°C

This Digital Thermometer was calibrated against National Institute of Standards and Technology Traceable Instrumentation.
A Test Uncertainty Ratio of at least 3.4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full.

Wallace Berry

Wallace Berry, Technical Manager

Maintaining Accuracy

In our opinion, once calibrated your Digital Thermometer should maintain its'accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 308 West Edgewood Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com

Bios International Corporation • 10 Park Place, Butler, NJ 07405 USA
Phone (973) 492 8400 Fax (973) 492 8270 Web www.biosint.com

calibration certificate

Report No. 22001
Product DCL-MH
Serial No. 6402
Mfg. Date November 24, 2003

DryCal DC1, DC2 and DC Lite Flow Calibrators are all calibrated using the same methodology. Each device is dynamically tested by comparing it to a Laboratory Standard primary piston prover of much higher accuracy, (±0.25%) but of similar operating principles. Flow generators of ±0.003% stability (included in prover accuracy) are used for the comparison. Use of provers of similar construction to the devices under test assures the validity of the flow generator as a transfer standard.

The primary Laboratory Standards are qualified by direct measurement of their dimensions (diameter, length of measured path, time base) against NIST-traceable gauges and instruments. A rigorous analysis of their accuracy in accordance with the International Guide to Uncertainty in Measurements has been performed assuring their traceable accuracy. Test procedures assure temperature matching of the Laboratory Standards and the devices under test.

Calibration Standards Used

Asset Number	Description	Cal Date	Due Date
ML-500-10 1064	ML-500 Low Flow Cell	11/14/2003	11/14/2004
ML-500-24 1086	ML-500 Medium Flow Cell	11/14/2003	11/14/2004
ML-500-44 1070	ML-500 High Flow Cell	11/14/2003	11/14/2004

All units calibrated in accordance with Bios International Corporation test number PR01-10 Rev B.
Expanded uncertainty ±0.25% at two times coverage.

As Shipped Test Data:

Laboratory Environment:

Temperature Ambient: 21.98°C Pressure Ambient: 754.2 mmHg Humidity Ambient: 34 %

Instrument Reading ml/min	Lab Standard Reading ml/min	Lab Standard Unit #	Deviation Percentage	Allowable Deviation	Condition Shipped
201.6	200	1064	0.80	1.00%	in tolerance
504.2	500.4	1086	0.76	1.00%	in tolerance
2017	2002	1070	0.75	1.00%	in tolerance
5049	5002.5	1070	0.93	1.00%	in tolerance
17140	17025	1070	0.68	1.00%	in tolerance

Calibration Notes 0

By: Sonia Otero
Sonia Otero
Calibration Technician

Calibration Date: 11/25/03

All calibrations performed in accordance with ISO 17025.

Certificate of Accuracy

Transfer Standard Type: Barometric Pressure/Altimeter

Transfer standard model: Pretel AltiPlus A2
Serial number: 27806
submitted by/owner: Hoefler Consulting Group

Was compared to Precision Absolute Reference Barometer:
Model number: 355-AI0900 Serial number: 913930-M1
Certified accuracy of ± 0.007"Hg
NIST traceable to Ruska Deadweight Tester SN 38342/C-85

Date: 4/17/2004

Lab temperature	71.5	°F
Lab pressure	652.30	mm Hg

Reference barometer ("Hg)	Transfer Standard ("Hg)	Difference from Reference ("Hg)	Transfer Standard Correction* ("Hg)
24.00	24.06	0.06	-0.06
25.68	25.74	0.06	-0.06
26.00	26.06	0.06	-0.06
28.00	28.06	0.06	-0.06
30.00	30.06	0.06	-0.06

Note:
If no sign is given on the correction, the true pressure is higher than the indicated pressure. If the sign is negative, the true pressure is lower than the indicated pressure.

Transfer Standard adjustments made? YES ☐ **NO** ☒
Post-calibration measurements:

Reference barometer ("Hg)	Transfer Standard ("Hg)	Difference from Reference ("Hg)	Transfer Standard Correction* ("Hg)

Reviewed: R L S Date: 4-17-04

Chinook Engineering
a division of Inter-Mountain Laboratories, Inc.
555 Absaraka Street
Sheridan, Wyoming 82801 USA
(307) 672-7790
chinook@imlinc.com

VAISALA Certificate of Calibration

Report #: 071103-X0740015 RMA #: 95-36712 Calibration Date: Jul-11-2003
Model #: HMI 41/HMP 45 Serial #: X0650080/X0740015
Instrument Range: 0 to 100%RH
Calibration Procedure: 11603100
Recommended Calibration Due Date: Jul-11-2004

Customer: HOEFLER CONSULT CORP.
City, State: ANCORAGE, AK

This unit was calibrated by adjusting its reading at 0% against dry nitrogen and at 75% against reference humidity and temperature instrument, Vaisala model HMP233. Additional instrument verification checkpoints were made against HMP233 reference at 11%RH and 33%RH. Calibration and instrument verification sequences utilize dry nitrogen and a set of controlled aqueous salt solutions Vaisala model HMK13B. Laboratory ambient conditions are maintained at a temperature of 22 °C ± 1 °C with relative humidity level of 50%RH ± 5%RH. The calibration uncertainty is presented at 95% confidence level, k=2. The calibration uncertainty is ± 0.6%RH.

Calibration Data (As Found)			
Out of Tolerance: Yes			
Temperature Calibration, °C			
Reference	Unit Under Test	Error	± Tolerance, °C
21.96	22.10	0.14	0.20
Humidity Calibration, %RH			
Reference	Unit Under Test	Error	± Tolerance, %
0.10	-0.40	-0.50	2.00
11.30	10.50	-0.80	2.00
32.60	30.50	**-2.10**	2.00
75.50	70.10	**-5.40**	2.00
Calibration Data (As Left)			
Temperature Calibration, °C			
Reference	Unit Under Test	Error	± Tolerance, °C
22.10	22.20	0.10	0.20
Humidity Calibration, %RH			
Reference	Unit Under Test	Error	± Tolerance, %
0.10	0.10	0.00	2.00
11.30	11.30	0.00	2.00
32.60	32.80	0.20	2.00
75.50	75.50	0.00	2.00

The results of this calibration are traceable to the National Institute of Standards and Technology through NIST Test Report Number TN267908-03, dated Oct. 22, 2002. Vaisala's calibration system has been established to meet the requirements of ANSI/NCSL Z540-1-1994. This certificate can not be reproduced, except in full, without the expressed written consent of Vaisala. ISO 9002 certified.

Calibration Equipment Used: Workstation 6			
Model Number	Serial Number	Calibration Date	Due Date
Power Supply	3267489	Oct. 16, 2002	Oct. 16, 2004
Fluke 45	7517016	Jan. 23, 2003	Jan. 23, 2004
HMK13B	P3940001	May. 13, 2003	Nov. 13, 2003
HMP233	V4310009	Apr. 23, 2003	Jul. 23, 2003

Ambient Conditions	
Temperature:	22.00 °C
Humidity:	51.15 %RH

Approved By

Technical Operator
Edwige Mehu

Mailing address:
Vaisala Inc.
100 Commerce Way
Woburn, MA 01801-1068

Tel. (781) 933-4500
Fax (781) 933-8029
http://www.vaisala.com

Houston Precision, Inc.
8729 Gulf Freeway
Houston, TX 77017-6504

Calibration Report

Company:	Hoeffler Consulting Group	**Doc.#**	6902
Address:	701 Sesame Street, Suite 200	**Date:**	3/3/2003
	Anchorage, AK 99503	**PO#:**	None
Contact:	Chris Lindsey	**Page:**	1
Department:			
Gage:	Torque Watch	**Control:**	4864
Mfg:	Waters	**Model:**	366-3
Location:	Calibration Lab	**Serial#:**	4864
Received Condition:	In Tolerance		

The instrument listed below meet or exceed published specifications and has been calibrated under controlled conditions and is traceable to the National Institute of Standards and Technology (N.I.S.T), or to accepted intrinsic standards of measurement, or by the ratio type of self-calibration techniques. We conform to ANSI/NCLS Z540-1-1994, and ISO/IEC Guide 25/17025.

oz/in range	Reading Received	Reading after Adjust	Final Reading
0.009	0.010	None	0.010
0.150	0.152	None	0.152
0.024	0.025	None	0.025
0.030	0.031	None	0.031

COMMENTS:

Reference HPI S/O# 9950

Standards Used MFG.	Model	Certification
Torque Tester	7095	822/2622

Gage Status: PASS **Next Calibration Due: 3/3/2004**

Certified by: Denice V. Mills Signature: Denice V Mills

This certificate is not valid unless all pages are present.

Laboratory Environmental Conditions: Temperature: 20C +/- 2C, Relative Humidity: between 40% and 60%.

Calibration measurements are performed in accordance with guidelines set forth in ANSI/NCSL Z540-1-1994, ISO10012-1, ISO/IEC 17025, the ISO 9000/QS9000 series of quality standards and Houston Precision's Quality Manual dated: 6/15/01, Rev. 1.

* If additional information regarding this calibration is required, please contact this laboratory.
* All calibrations have been performed under the supervision and authority of Jose L. Rivera, Lab Manager
* This Report of Test may not be reproduced except in full without express written permission of Houston Precision, Inc.

Meteorological Instruments

YOUNG

Certificate of Calibration and Testing

Test Unit:			
Model:	18801	Serial Number:	CA01674
Description:	Anemometer Drive - 10 to 10,000 Rpm		
	- Comprised of Models 18820 Control Unit & 18830 Motor Assembly		

R.M. Young Company certifies that the above equipment has been inspected and calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technologies (NIST).

Nominal Motor Rpm	Output Frequency (1) Hz	Calculated Rpm (2)	Indicated Rpm (3)
600	320	600	600
1200	640	1200	1200
2400	1280	2400	2400
4200	2240	4200	4200
6000	3200	6000	6000
8100	4320	8100	8100
9900	5280	9900	9900
☒ Clockwise and Counterclockwise rotation verified			

(1) Measured at the optical encoder output
(2) Frequency output produces 32 pulses per revolution of the motor shaft
(3) Indicated on the Control Unit LCD display

*Indicates out of tolerance

☒ No Calibration Adjustments Required ☐ As Found ☐ As Left

Traceable frequency meter used in calibration DP4863

Date of inspection 21 November 2003

Tested By EJC

R.M. YOUNG COMPANY 2801 Aero Park Drive, Traverse City, Michigan 49686 USA
Tel: 231-946-3980 Fax: 231-946-4772 Email: met.sales@youngusa.com

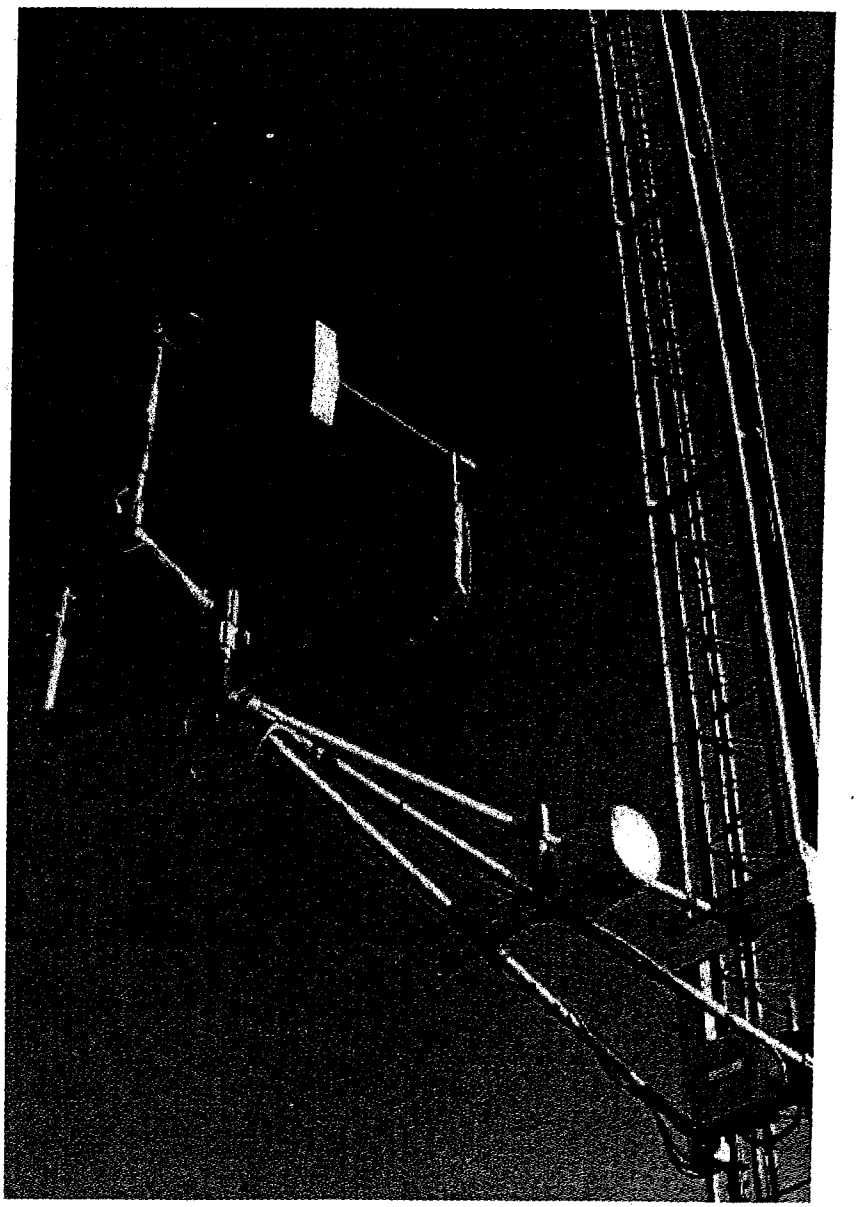
Appendix C

F460 WIND SENSORS

FEATURES

- **High Survivability**
- **Excellent Dynamic Response**
- **Low Threshold**
- **Low Power CMOS Design**
- **Optional External Heaters**

Climatronics' F460 Wind Sensors are capable of operation in virtually all weather conditions. Designed to meet the requirements of Specification No. F460-SP001 for the National Weather Service, the durability of these sensors makes them ideal for multi-level tower installations. Although moderately priced, the F460 wind sensors offer the combination of low starting threshold, quick response, and high accuracy with excellent reliability over a wide range of operating conditions.



The F460 Wind Speed Sensor P/N 100075 monitors the wind speed with a three-cup anemometer. An LED photo chopper device provides a frequency output directly proportional to the wind speed. NIST traceability is optionally available for each anemometer cup assembly by comparison testing against a NIST transfer standard in our wind tunnel test facility.

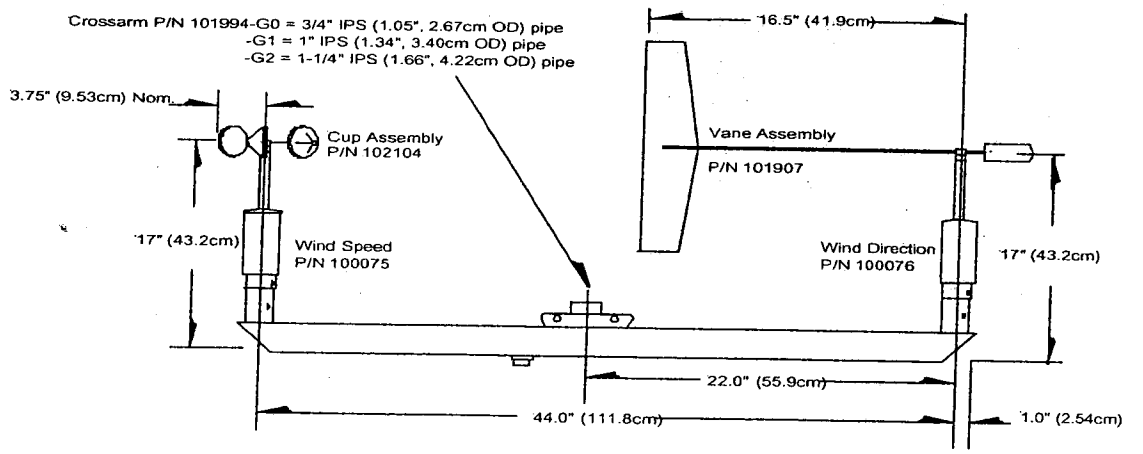
The F460 Wind Direction Sensor, P/N 100076, consists of a counter-balanced, lightweight vane and a precision, low torque, highly reliable potentiometer that yields a voltage output proportional to the wind direction. Once properly oriented on the keyed cross-arm, the wind direction sensor may be removed or replaced without requiring reorientation.

Installation is a simple matter of fastening each sensor to the crossarm, P/N 101994, which fits a ¾, 1, or 1¼ inch IPS pipe. Optional, thermostatically controlled external heaters are also available. Our single-board signal conditioner, the Universal Interface Module (UIM), can be used with the F460 sensors. Please consult the Universal Interface Module (UIM) data sheet for more details. The sensors can also be directly interfaced to Climatronics' IMP-800 series of data loggers or other commonly available data acquisition units.

The Component Anemometer, P/N 102236, can be used in conjunction with the F460 System to measure the vertical component of the wind. Consult the Vertical Component Anemometer data sheet for additional details.

SPECIFICATIONS

	F460 Wind Speed P/N 100075	F460 Wind Direction P/N 100076
PERFORMANCE		
Accuracy	0.15 mph (± 0.07 m/s) or ± 1.0% of true air speed (whichever is greater)	± 2 degrees
Threshold	0.5 mph (0.22 m/s)	0.5 mph (0.22 m/s)
Distance Constant	102104 LEXAN <1.5m (4.9 ft.) 101287 HD Aluminum <4.0m (13.1 ft.) 100057 Stainless Steel <2.4m (7.9 ft.)	101907 Standard <1.0m (3.0 ft.) 101288 Heavy Duty <2.5m (8.2 ft
Damping Ratio	N/A	>0.4 at 10° initial angle of attack
Operating Range	0-125 mph (0-60 m/s)	0 to 360 degrees - mechanical
ELECTRICAL SPECIFICATIONS		
Signal Output	Nominal 2.0 Vpp into 2.0 Kohm, frequency proportional to wind speed, amplitude dependant on supply voltage	Variable DC voltage, magnitude proportional to wind direction
Power Requirements	5-15 Vdc @ 1 mA nominal	Max. 1 mA through 10 Kohms
PHYSICAL SPECIFICATIONS		
Size	2.25 in (5.7cm) max. diameter 11.5 in (29.2cm) high	2.25 in (5.7cm) max. diameter 11.5 in (29.2cm) high
Weight	Less than 2 lbs. (0.9 kg.)	Less than 2 lbs. (0.9 kg.)
Turning Radius	3.75 inch (9.5 cm)	16.5 inch (41.9 cm)
Operating Temperature	-40° to +140° F (-40° to +60° C)	-40° to +140° F (-40° to +60° C)
CROSSARM SPECIFICATIONS		
Length	45 inches (114.3 cm)	
Weight	7 lbs. (3.2 kg.)	
Mounting	1.66 inch (4.2 cm) - O.D. 1-1/4" IPS pipe (3/4" & 1.0" IPS also available)	
SENSOR HEATER SPECIFICATIONS		
Internal (P/N 101263)	12 Vdc, 2 Watts per sensor	
External (P/N 101235)	115 Vac/60Hz 20 Watts per sensor, thermostatically controlled	



Climatronics Corporation
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E-Mail: sales@climatronics.com

Rev. 2/13/01

Use of Synchronous Motors with Climatronics P/N 100075 F460 Wind Speed Sensors

Purpose:
A synchronous motor is used to spin a wind speed sensor at a known rate to check system linearity.

Technique:
The motor should be connected to the sensor with a "hard" coupling. A piece of tubing may accelerate sensors at higher speeds. Do not use this. Climatronics motors are provided with the correct "hard" coupling for this application.

Conversions:
Meters per Second = MPH X 0.44074
Knots = MPH X 0.86897
Kilometers per Hour = MPH X 1.6094

Calculations:

Cup Type	Cupset P/N	Output Frequency	Velocity in MPH	Velocity in M/S
Lexan	102104	RPM/2	= ((Frequency / 9.511) + 0.3) = ((RPM / 19.022) + 0.3)	= ((Frequency / 21.28) + 0.13) = ((RPM / 42.55) + 0.18)
Heavy Duty Aluminum	101287	RPM/2	= ((Frequency / 9.511) + 0.5) = ((RPM / 19.022) + 0.5)	= ((Frequency / 21.28) + 0.22) = ((RPM / 42.55) + 0.22)
Stainless Steel	100057	RPM/2	= ((Frequency / 10.425) + 0.5) = ((RPM / 19.022) + 0.5)	= ((Frequency / 23.31) + 0.22) = ((RPM / 46.64) + 0.22)
Vinyl	100083	RPM/2	= ((Frequency / 9.511) + 0.5) = ((RPM / 19.022) + 0.5)	= ((Frequency / 21.28) + 0.22) = ((RPM / 42.55) + 0.22)

CLIMATRONICS CORPORATION

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Rock Creek Ambient Air and Meteorological Monitoring Station PM_{10} Audit – Third Quarter 2004

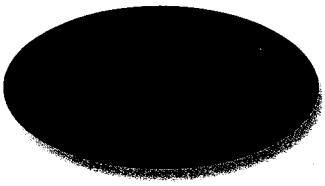
for the

Rock Creek Project

Nome, Alaska

prepared for

Alaska Gold Company



CONSULTING GROUP

October 2004

Third Quarter 2004 Audit Report

for the

Rock Creek Ambient Air and Meteorological Monitoring Project

Nome, Alaska

October 2004

prepared for

Alaska Gold Company

prepared by

Hoefler Consulting Group
3401 Minnesota Drive, Suite 300
Anchorage, Alaska 99503
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APPENDICES

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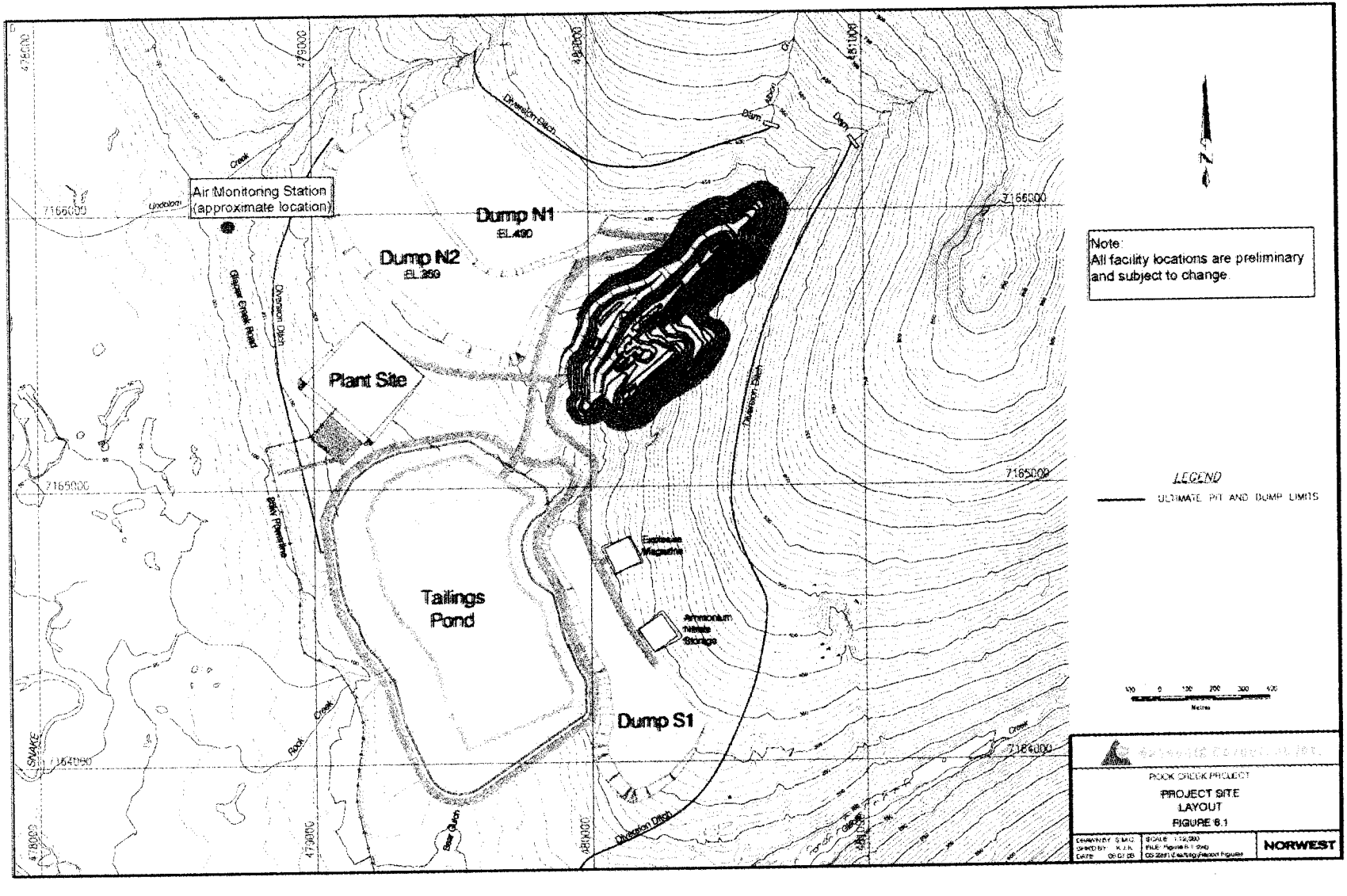
1.0 INTRODUCTION

Hoefler Consulting Group currently operates a meteorological and air monitoring station on behalf of Alaska Gold Company at the Rock Creek Mine Development Site, 7 miles north of Nome, Alaska at 64° 37' N latitude and 165° 26' W longitude. The location of the station is shown in Figure 1-1.

The station is made up of a 12-meter tower equipped with meteorological sensors and two particulate matter samplers. The two BGI PQ100 samplers measure the ambient concentration of aerosols with an effective aerodynamic diameter of 10 µm or less (PM_{10}).

This document reports the results of the audit of the station conducted on September 23, 2004. This report has been prepared for Alaska Gold as a step toward demonstrating that the ambient PM_{10} baseline monitoring conducted at the site meets the ambient air monitoring guidelines forth by the U.S. Environmental Protection Agency (EPA).

Figure 1-1. Map of the Rock Creek Development and Surrounding Area



2.0 PERFORMANCE AUDIT

A performance audit was conducted on the station's two PM_{10} samplers. Data sheets from the performance audit can be found in Appendix A.

2.1 Performance Audit Methodology

The flow rates of both PM_{10} samplers were measured by a NIST-traceable BIOS DC-Lite flow transfer standard (FTS), which was last calibrated November 25, 2003. During the PM_{10} performance audit, the outputs of the 2-meter temperature and pressure sensors from the meteorological tower were read with a CR10X portable keyboard display. The results given by the meteorological sensors were used to adjust the expected volumetric flow rate though the PM_{10} samplers, since these are mass-controlled samplers. All meteorological equipment was audited and calibrated on May 27, 2004 and found to be in good working order.

2.2 Performance Audit Results

JR Wilcox conducted the audit on September 23, 2004. A summary of the performance audit results is provided in Table 2-1.

Audit data sheets are provided in Appendix A. Certification sheets of audit instruments are provided in Appendix B.

In order to be within recommended accuracy, the sampler flow rate as measured by a NIST-traceable FTS should be within 10 percent of the flow rate indicated by the sampler and 10 percent of the sampler's design flow rate (16.67 L/min). The audits were conducted under ambient conditions of 5.9°C and 997 mb.

Table 2-1. PM Sampler Audit Summary

Sampler	Percent Difference		Pass/Fail
	FTS vs. Indicated Flow	FTS vs. Design Flow	
Primary	3.7%	3.7%	Pass
Co-located	0.5%	0.5%	Pass

3.0 COMMENTS AND RECOMMENDATIONS

- Both PM_{10} samplers passed the flow rate audits.
- The station appeared to be in good working order.

4.0 REFERENCES

State of Alaska. Alaska Department of Environmental Conservation. State of Alaska Quality Assurance Manual for Ambient Air Quality Monitoring. Juneau, AK: ADEC, 1996.

United States. Environmental Protection Agency. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA-450/4-87-007. Research Triangle Park, NC: OAQPS, 1987.

Appendix A
Performance Audit Sheets

PM_{10} Sampler Audit Data Sheet

Rock Creek Air Monitoring Project

Operator JR Wilcox Date/Time of Audit 3:15 pm MDT 9/23/04

PM_{10} Sampler: Make/Model BGI PQ100 S/N 374

Type of sampler (circle one): (Primary) Co-located

Flow Check Device Bios DC-Lite S/N 6402 Calibration Date 3/25/03

Ambient Temp 5.9 °C Ambient Press 997. mb

Flow Transfer Standard Flow Rate	17.28 L/min
Sampler Indicated Flow Rate	16.67 L/min
Sampler Design Flow Rate	16.67 L/min

% Difference of Sampler from Transfer Standard QC Flow Rate	3.7 %
% Difference of Transfer Standard Flow Rate from Design Flow Rate	3.7 %

Comments:

PM_{10} Sampler Audit Data Sheet

Rock Creek Air Monitoring Project

Operator JR Wilcox Date/Time of Audit 3:30 pm MDT 9/23/04

PM_{10} Sampler: Make/Model BGI PQ100 S/N 373

Type of sampler (circle one): Primary (Co-located)

Flow Check Device Bios DC-Lite S/N 6402 Calibration Date 11/25/03

Ambient Temp 5.9 °C Ambient Press 997.19 mb

Flow Transfer Standard Flow Rate	16.75 L/min
Sampler Indicated Flow Rate	16.67 L/min
Sampler Design Flow Rate	16.67 L/min

% Difference of Sampler from Transfer Standard QC Flow Rate	0.5 %
% Difference of Transfer Standard Flow Rate from Design Flow Rate	0.5 %

Comments:

Appendix B
Audit Equipment Certifications

Bios International Corporation • 10 Park Place, Butler, NJ 07405 USA
Phone (973) 492 8400 **Fax** (973) 492 8270 **Web** www.biosint.com

calibration certificate

Report No. 22001
Product DCL-MH
Serial No. 6402
Mfg. Date November 24, 2003

DryCal DC1, DC2 and DC Lite Flow Calibrators are all calibrated using the same methodology. Each device is dynamically tested by comparing it to a Laboratory Standard primary piston prover of much higher accuracy, (±0.25%) but of similar operating principles. Flow generators of ±0.003% stability (included in prover accuracy) are used for the comparison. Use of provers of similar construction to the devices under test assures the validity of the flow generator as a transfer standard.

The primary Laboratory Standards are qualified by direct measurement of their dimensions (diameter, length of measured path, time base) against NIST-traceable gauges and instruments. A rigorous analysis of their accuracy in accordance with the International Guide to Uncertainty in Measurements has been performed assuring their traceable accuracy. Test procedures assure temperature matching of the Laboratory Standards and the devices under test.

Calibration Standards Used

Asset Number	Description	Cal Date	Due Date
ML-500-10 1064	ML-500 Low Flow Cell	11/14/2003	11/14/2004
ML-500-24 1086	ML-500 Medium Flow Cell	11/14/2003	11/14/2004
ML-500-44 1070	ML-500 High Flow Cell	11/14/2003	11/14/2004

All units calibrated in accordance with Bios International Corporation test number PR01-10 Rev B.
Expanded uncertainty ±0.25% at two times coverage.

As Shipped Test Data:

Laboratory Environment:

Temperature Ambient: 21.98°C Pressure Ambient: 754.2 mmHg Humidity Ambient: 34 %

Instrument Reading ml/min	Lab Standard Reading ml/min	Lab Standard Unit #	Deviation Percentage	Allowable Deviation	Condition Shipped
201.6	200	1064	0.80	1.00%	in tolerance
504.2	500.4	1086	0.76	1.00%	in tolerance
2017	2002	1070	0.75	1.00%	in tolerance
5049	5002.5	1070	0.93	1.00%	in tolerance
17140	17025	1070	0.68	1.00%	in tolerance

Calibration Notes 0

By: Sonia Otero Calibration Date: 11/25/03

Sonia Otero
Calibration Technician

All calibrations performed in accordance with ISO 17025.

Certificate of Accuracy

Transfer Standard Type: Barometric Pressure/Altimeter

Transfer standard model: Pretel AltiPlus A2
Serial number: 27806
submitted by/owner: Hoefler Consulting Group

Was compared to Precision Absolute Reference Barometer:
Model number: 355-AI0900 Serial number: 913930-M1
Certified accuracy of ± 0.007"Hg
NIST traceable to Ruska Deadweight Tester SN 38342/C-85

Date: 4/17/2004

Lab temperature	71.5	°F
Lab pressure	652.30	mm Hg

Reference barometer ("Hg)	Transfer Standard ("Hg)	Difference from Reference ("Hg)	Transfer Standard Correction* ("Hg)
24.00	24.06	0.06	-0.06
25.68	25.74	0.06	-0.06
26.00	26.06	0.06	-0.06
28.00	28.06	0.06	-0.06
30.00	30.06	0.06	-0.06

Note:
If no sign is given on the correction, the true pressure is higher than the indicated pressure. If the sign is negative, the true pressure is lower than the indicated pressure.

Transfer Standard adjustments made? YES ☐ **NO** ☒
Post-calibration measurements:

Reference barometer ("Hg)	Transfer Standard ("Hg)	Difference from Reference ("Hg)	Transfer Standard Correction* ("Hg)

Reviewed: RJL Date: 4-17-04

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(307) 672-7790
chinook@imlinc.com

Rock Creek Ambient Air and Meteorological Monitoring Station Systems Audit – Fourth Quarter 2004

for the

Rock Creek Project

Nome, Alaska

prepared for

Alaska Gold Company

May 2005

Fourth Quarter 2004 Systems Audit Report

for the

Rock Creek Ambient Air and Meteorological Monitoring Project

Nome, Alaska

May 2005

prepared for

Alaska Gold Company

prepared by

Hoefler Consulting Group
3401 Minnesota Drive, Suite 300
Anchorage, Alaska 99503
907-563-2137

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1.0 INTRODUCTION

Hoefler Consulting Group currently operates a meteorological and air monitoring station on behalf of Alaska Gold Company at the Rock Creek Mine Development Site, 7 miles north of Nome, Alaska at 64° 37' N latitude and 165° 26' W longitude. The location of the station is shown in Figure 1-1.

The station is made up of a 12-meter tower equipped with meteorological sensors, a precipitation gauge and two particulate matter samplers. The meteorological monitoring tower meets the requirements of the Prevention of Significant Deterioration (PSD) program administered by the Alaska Department of Environmental Conservation (ADEC).

The two BGI PQ100 samplers measure the ambient concentration of aerosols with an effective aerodynamic diameter of 10 μm or less (PM_{10}). The meteorological parameters are measured by the following sensors:

- Wind Speed: Climatronics Model F460 3-cup anemometer with Lexan cups
- Wind Direction: Climatronics Model F460 wind vane
- Temperature and ΔT: Met One 062MP thermometers (at 2 and 10 meters)
- Relative Humidity: Vaisala HMP45AC Relative Humidity Probe
- Barometric Pressure: Vaisala PTB101B Barometer
- Precipitation: Texas Electronics TE25WS Rain Gauge (seasonally equipped with a snowfall adaptor)

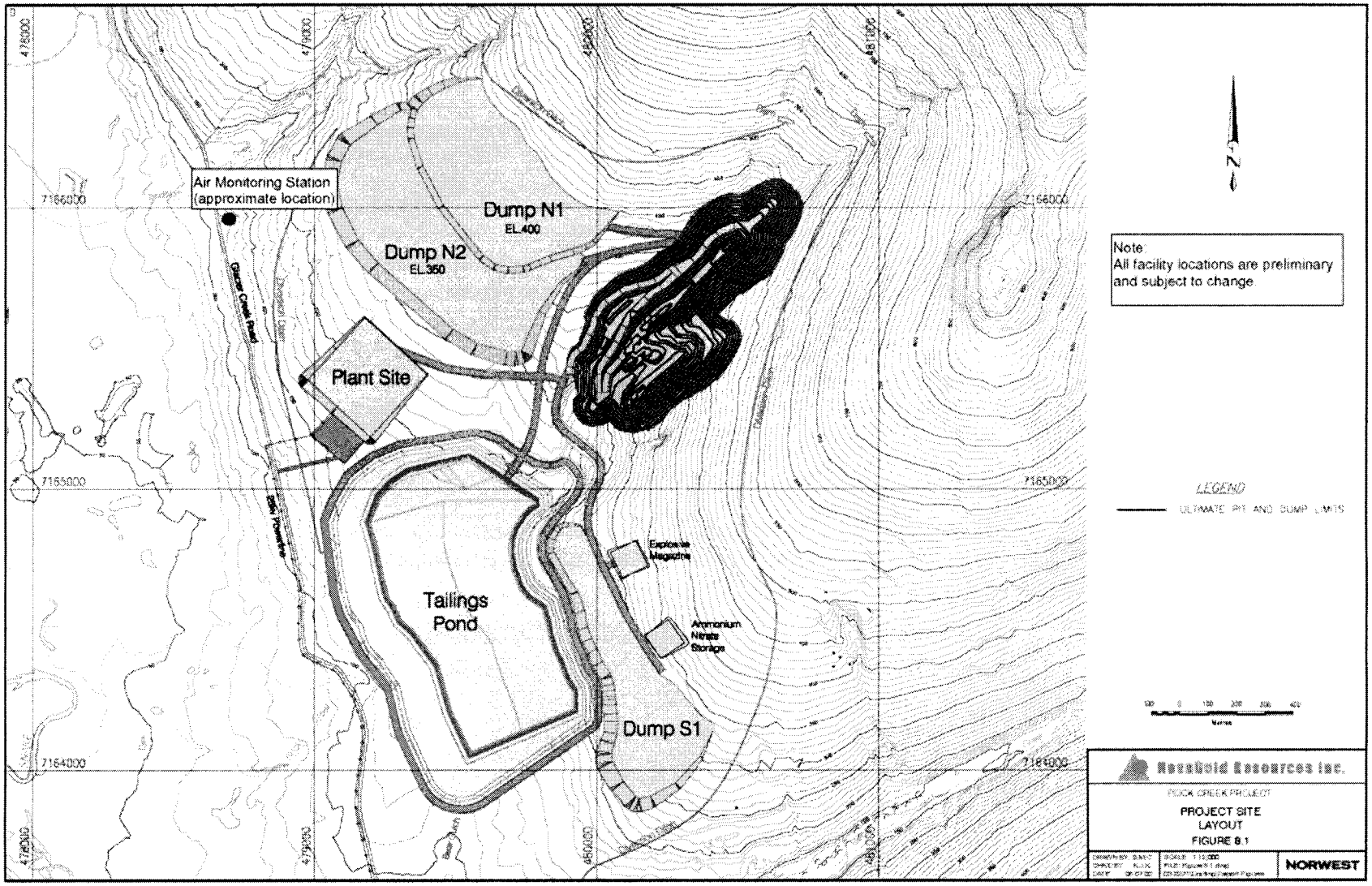
The anemometer and wind vane are attached to the top of the tower on a crossarm, the thermistors are mounted at 2 meters inside of an RM Young motor-aspirated radiation shield. The collected data are stored onsite in a Campbell CR10X Data Acquisition System (DAS). The station is powered by solar panels and a thermal electric generator connected to deep cycle 12V lead acid batteries. The DAS is accessed for data retrieval and programming either in the field with a PC or through the cellular phone attached to the DAS.

This document reports the results of the audit of the station conducted on December 28, 2004. This report has been prepared for Alaska Gold as a step towards demonstrating that the meteorological data collected by the station meets the applicable PSD requirements as set forth by the U.S. Environmental Protection Agency (EPA).

In the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Part 1, Appendix 15, EPA provides guidance for conducting systems audits. EPA recommends that a systems audit be conducted to assess compliance with established regulations governing the collection, analysis, validation, and reporting of ambient air quality data. A systems audit should be conducted at initial startup of the program and annually, thereafter.

The initial systems audit was conducted on January 8-9, 2004 by Eric Brudie. This audit was a comprehensive and detailed review of the project plan, station design, data processing procedures, laboratory operations, data sheet design, and project documentation. Since most aspects of this project have remained essentially unchanged, this report is intended to build upon the previous systems audit by reviewing current condition of the site, rather than re-examining the project fundamentals already covered so thoroughly by Mr. Brudie. My observations are contained in Section 3.

Figure 1-1. Map of the Rock Creek Development and Surrounding Area



2.0 PERFORMANCE AUDIT

A performance audit was conducted on all required parameters measured by the station. Data sheets from the performance audit can be found in Appendix A.

2.1 Performance Audit Methodology

During the performance audit, the output of each meteorological sensor was read with a CR10X portable keyboard display. The results given by each meteorological sensor were compared to the results given by the calibrated audit instruments. The differences between the station and the audit instruments were compared with established PSD limits to determine the accuracy of each sensor. Threshold torques for wind speed and direction were manually measured and compared with established PSD limits. Table 2-1 summarizes the audit methods and limits used to verify each parameter.

Table 2-1. Performance Audit Methods and Acceptable Limits

Parameter	Audit Method	PSD Limit
DAS Time	NOAA Clock	≤ ± 5 minutes from AST
Wind Direction Alignment	GPS	≤ ± 5° from true bearing per point
Wind Direction Accuracy	Linearity tester and cross-arm square	≤ ± 5° per audit point
Wind Direction Linearity		≤ 3° mean absolute average
Wind Direction Torque	Torque watch	≤ 0.104 oz-in (11 g-cm)
Wind Speed Accuracy	Synchronous motor	≤ ± 0.2 m/s ±5% observed
Wind Speed Torque	Torque watch	≤1.0 g-cm
Temperature Accuracy	NIST thermometer	≤± 0.5°C
Temperature Difference (ΔT)	Co-location of 2- and 10-meter thermometers	≤± 0.1°C
Humidity (as dew point)	NIST RH Probe	± 1.5°C
Barometric Pressure	NIST Barometer	≤ ± 3 mb

2.1.1 Data Acquisition System

An audit of the DAS was conducted by comparing of all DAS outputs to the audit standards, as described below. The DAS time was checked against an instantaneous time reading from the National Oceanic and Atmospheric Administration (NOAA) clock in Boulder, Colorado via a global position system (GPS).

2.1.2 Temperature

The two air temperature thermometers (2-meter and 10-meter) were audited against a National Institute of Standards and Technology (NIST) traceable digital thermometer to determine system accuracy. The 2- and 10-meter thermometers' readings were compared to the NIST traceable digital thermometers and to each other in an ice/water bath and water baths of varying temperatures.

2.1.3 Wind Direction

The wind direction sensor was audited "as-found" to determine the accuracy of the alignment with respect to true north (true azimuth alignment) using a hand-held GPS. A Garmin GPS 12 CX model was used to estimate the position of the auditor with respect to the tower. After a waypoint is marked into the GPS at the tower's position, the tail of the wind vane is aligned with the auditor's position at a distance of several hundred feet from the tower. In reference to the aligned wind vane, the auditor's bearing on the GPS with respect to the waypoint marking the tower's position provides the true direction of the wind vane. The GPS-derived direction is then compared with the output from the DAS to calculate a percent difference.

After the completion of the "as-found" audit, the wind instruments were removed from the tower, and further tests were preformed. Wind direction linearity and accuracy were determined by mounting the wind vane on a Climatronics linearity check wheel and comparing the DAS output with the actual orientation of the vane in 30° increments.

The wind direction threshold value was tested using a Waters torque watch to measure wind vane torque. The highest torque required to turn the wind vane was compared to the established limits.

The wind vane sensor was placed back on the tower after all necessary audits were completed. A final "as-left" audit was conducted on the alignment of the sensor, identical to the "as-found" audit carried out prior to removing the sensor from the tower.

2.1.4 Wind Speed

The anemometer was audited to determine relative accuracy for wind speed and sensor torque threshold. First, the spinning shaft of the anemometer was rotated at several different known rates by an attached variable-speed RM Young synchronous motor. Each rate of revolution is equivalent to a speed, the relationship being given by the manufacturer's anemometer calibration formulas (Appendix B). The equivalent speed of the synchronous motor was

compared with the instrument output.

Next, a Waters torque watch was attached to the spinning shaft of the anemometer. Several torque readings were made within different quadrants along the axis of rotation of the shaft. The maximum reading was recorded for the threshold of force required to turn the spinning shaft of the anemometer.

2.1.5 Humidity

The station humidity probe's temperature and relative humidity readings at ambient conditions were converted to a dew point and compared to dew point indicated by a NIST traceable humidity probe.

2.1.6 Barometric Pressure

The station barometer reading was compared at ambient conditions to the reading from a NIST traceable digital barometer.

2.1.7 PM_{10} Sampler Flow Rate

The sampler flow rates were measured by a NIST traceable flow transfer standard (FTS).

2.2 Performance Audit Results

JR Wilcox conducted the audit on December 28, 2004. Each sensor was challenged with certified audit equipment, and the starting torques of the anemometer and wind vane were tested. The sensors were tested for compliance with the PSD performance accuracy requirements and starting torque threshold limits. A summary of the performance audit results is provided in Table 2-2 for the met tower and in table 2-3 for the PM samplers.

Complete audit reports are provided in Appendix A. Certification sheets of audit instruments are provided in Appendix B. Manufacturer data sheets for the meteorological equipment that display wind speed calibration formulas and starting torques for wind direction and wind speed are provided in Appendix C.

Table 2-2. Met Audit Summary

Parameter	PSD Limit	Error[1]	Pass/Fail
DAS Time (Min:Sec)	≤ ±5:00	-2:52	Pass
Wind Direction Alignment (as found)	≤ ±5°	+5°	Pass
Wind Direction Alignment (as left)	≤ ±5°	-3°	Pass
Wind Direction Torque[2]	≤ 0.104 oz-in	0.06 oz-in	Pass
Wind Direction Accuracy	≤ ±5°	-2.805°	Pass
Wind Direction Linearity	≤ 3°	1.44°	Pass
Wind Speed Accuracy	≤ ±0.2 m/s ±5%	0.00 m/s	Pass
Wind Speed Torque	≤ 0.0049 oz-in	< 0.003 oz-in	Pass
Temperature Accuracy (2-meter)	≤ ±0.5°C	0.09°C	Pass
Temperature Accuracy (10-meter)	≤ ±0.5°C	0.32°C	Pass
Temperature Difference (ΔT)	≤± 0.1°C	0.05°C	Pass[3]
Humidity (as dew point)	± 1.5°C	+1.5°C	Pass
Barometric Pressure	≤ ± 3 mb	0.8 mb	Pass
Precipitation	≤ ± 10%	inoperative	Fail

In order to be within recommended accuracy, the sampler flow rate as measured by a NIST-traceable FTS should be within 7% of the flow rate indicated by the sampler and 10% of the sampler's design flow rate (16.67 L/min). The audits were conducted under ambient conditions of –13.2 °C and 1030 mb.

Table 2-3. PM Sampler Audit Summary

Sampler	% Difference		Pass/Fail
	FTS vs. Indicated Flow	FTS vs. Design Flow	
Primary	1.2%	0.7%	Pass
Co-located	1.2%	1.3%	Pass

[1] When several readings were taken, the maximum error is reported.
[2] Torque measurement after replacement of the wind direction sensor.
[3] See note in Section 3.0.

3.0 SYSTEM AUDIT OBSERVATIONS

- **All met station sensor & PM_{10} sampler parameters passed their audits, with the exception of precipitation**.

  - I observed that **the precipitation gauge had become inoperative** due to ice buildup inside of the snowfall adaptor. All precipitation data gathered since the installation of the snowfall adapter is therefore suspect. It has been agreed that the site technician will make routine inspections in the future for ice build up and remove it when it occurs. Data will also be inspected in Anchorage to check the consistency of Rock Creek's precipitation data with the Nome Airport's.

  - After the ice buildup had been removed, the site calibrator tested the precipitation gauge and found it to read 7.3% low, which is within the 10% tolerance range recommended by EPA.

  - ΔT was higher than the recommended value at 0 °C, but this was due to trouble getting temperature within the ice bath to homogenize to within 0.1 °C. This was suspected, and was confirmed by my subsequent 5/23/05 audit, which showed the probes to be within 0.1 °C of each other. No intervening repair or replacement of the probes occurred.

- While still functional, the **motor on the collocated PM10 sampler** is definitely showing signs of wear. The pump motor sounds very loud and took 20 minutes to reach the design flow rate (16.67 L/min). Initial flow rate was 8.6 L/min. Robbie O'Connor, the main site technician, reported that this pump has particular difficulty in the cold. However, it should be noted that the total volume over a 24-hour sampling period should not be significantly reduced by the first 20 minutes being slow. If this did significantly impact the total volume of air sampled, this would be noted on the sample collection forms. The site technician has brought the co-located unit indoors to thaw, and will inspect the inside of the unit for ice/snow build up, removing any snow, ice, or water found. If pump performance continues to deteriorate it will be noted during the routine site calibrations and a pump rebuild kit will be delivered to the station.

- **Alterations to the equipment** since the last site audit:

  - After wind vane S/N 4567 failed its torque audit, it was replaced by wind vane S/N 4007 on May 28, 2004.

- A precipitation gauge was installed on August 23rd, 2004. At the time of the systems audit, this gauge had been raised to about 2½ feet (at the base) above the platform to which it is mounted to prevent interference from snowpack buildup.

- A snowfall adapter was added to the precipitation gauge on September 23rd, 2004. The gauge was raised to its current height at this time.

- On December 2, 2004 a new precipitation gauge mounting system was installed and the windscreen was raised. These modifications were made to reduce the possibility of precipitation gauge movement during storms.

- All the original equipment appears to remain in conformance with the HCG monitoring and QA plan and therefore the EPA's Prevention of Significant Deterioration (PSD) specifications, with the exception of the precipitation gauge, as discussed below.

- While the **power system** design is fairly robust, the TEG pilot light has been repeatedly snuffed by high winds. This problem has not impacted station performance to date, but the installation of a wind-proof Breidert cap on the TEG's exhaust duct is recommended to prevent recurrence.

- The primary **operating personnel** were unchanged in 2004. Charlotte MacCay remains the Environmental Manager, Steve Mackey continues to be the site operator, and Robbie O'Conner remains the primary site technician. Several other site technicians have assisted Mr. O'Conner since the commencement of the monitoring project, but at present he is the only technician.

- **Robbie O'Conner** is the site technician responsible for the operation and routine maintenance of the PM10 samplers. Conversations with and observations of Robbie indicate that he was familiar and comfortable with the routine operation and maintenance of the samplers, including programming sampler runs, sampler cleaning, and filter handling. Robbie indicated that things have been running smoothly for the last few months.

- **IML Air Science** continued to be responsible for the gravimetric analysis the exposed filters. IML has continued to supply field operations with filters and to analyze filters and provide results in a satisfactory manner.

4.0 REFERENCES

State of Alaska. Alaska Department of Environmental Conservation. State of Alaska Quality Assurance Manual for Ambient Air Quality Monitoring. Juneau, AK: ADEC, 1996.

United States. Environmental Protection Agency. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA-450/4-87-007. Research Triangle Park, NC: OAQPS, 1987.

United States. Environmental Protection Agency. Meteorological Monitoring Guidance for Regulatory Modeling Applications. EPA-454-99-005. Research Triangle Park, NC: OAQPS, 2000.

United States. Environmental Protection Agency. Quality Assurance Handbook for Air Pollution Measurement Systems: Vol. IV -- Meteorological Measurements. EPA-600/4-90-003. Research Triangle Park, NC: ORD, 1995.

Yamartino, R.J. "A Comparison of Several "Single-Pass" Estimators of the Standard Deviation of Wind Direction." Journal of Climate Applied Meteorology 23 (1984): 1362-66.

Rock Creek Ambient Air and Meteorological Monitoring Station PM_{10} Audit – First Quarter 2005

for the

Rock Creek Project

Nome, Alaska

prepared for

Alaska Gold Company

May 2005

First Quarter 2005 Audit Report

for the

Rock Creek Ambient Air and Meteorological Monitoring Project

Nome, Alaska

May 2005

prepared for

Alaska Gold Company

prepared by

W. Dominic Shallies
Hoefler Consulting Group
3401 Minnesota Drive, Suite 300
Anchorage, Alaska 99503
907-563-2137

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APPENDICES

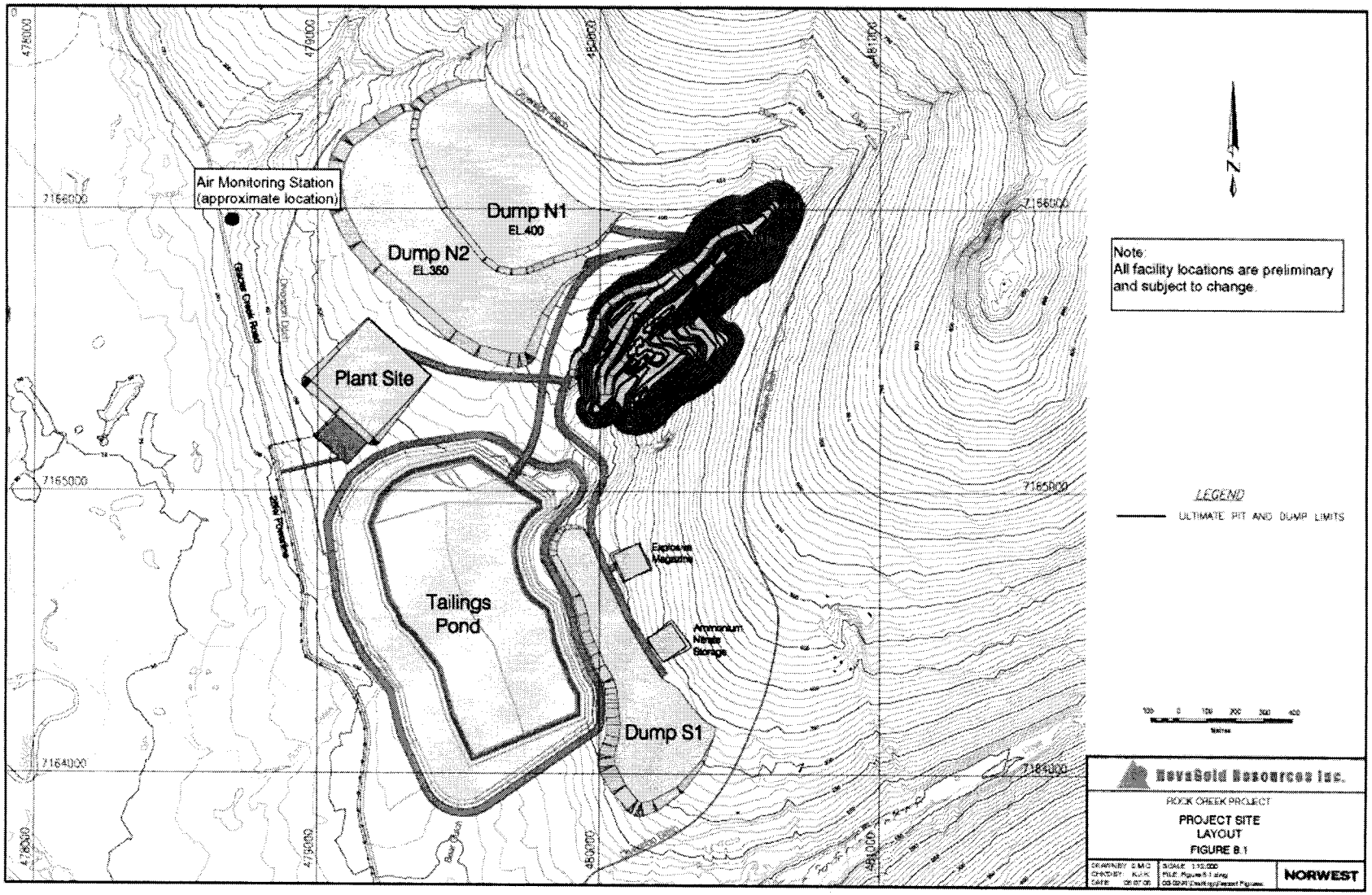
1.0 INTRODUCTION

Hoefler Consulting Group currently operates a meteorological and air monitoring station on behalf of Alaska Gold Company at the Rock Creek Mine Development Site, 7 miles north of Nome, Alaska at 64° 37' N latitude and 165° 26' W longitude. The location of the station is shown in Figure 1-1.

The station is made up of a 12-meter tower equipped with meteorological sensors and two particulate matter samplers. The two BGI PQ100 samplers measure the ambient concentration of aerosols with an effective aerodynamic diameter of 10 µm or less (PM_{10}).

This document reports the results of the PM_{10} audit of the station conducted on March 15, 2005. This report has been prepared for Alaska Gold as a step toward demonstrating that the ambient PM_{10} baseline monitoring conducted at the site meets the ambient air monitoring guidelines put forth by the U.S. Environmental Protection Agency (EPA).

Figure 1-1. Map of the Rock Creek Development and Surrounding Area



2.0 PERFORMANCE AUDIT

A performance audit was conducted on the station's two PM_{10} samplers. Data sheets from the performance audit can be found in Appendix A.

2.1 Performance Audit Methodology

The flow rates of both PM_{10} samplers were measured by a NIST-traceable BIOS DC-Lite flow transfer standard (FTS), which was last calibrated October 27, 2004. All flow audits were conducted using flow rates measured at actual temperature and pressure conditions.

During normal PM_{10} sampling, the outputs of the 2-meter temperature and pressure sensors from the meteorological tower are used to adjust the sample volume to standard conditions, since these are mass-controlled samplers. However, no adjustment of the sampler *flow rate* is necessary during audits conducted at actual temperature and pressure conditions.

2.2 Performance Audit Results

W. Dominic Shallies conducted the audit on March 15, 2005. A summary of the performance audit results is provided in Table 2-1.

Audit data sheets are provided in Appendix A. Certification sheets of audit instruments are provided in Appendix B.

In order to be within recommended accuracy, the sampler flow rate as measured by a NIST-traceable FTS should be within 10 percent of the flow rate indicated by the sampler and 10 percent of the sampler's design flow rate (16.67 L/min). The audits were conducted under ambient conditions of 1.55°C and 997 mb.

Table 2-1. PM Sampler Audit Summary

Sampler	Percent Difference		Pass/Fail
	FTS vs. Indicated Flow	FTS vs. Design Flow	
Primary	4.02%	4.2%	Pass
Co-located	4.52%	4.52%	Pass

3.0 COMMENTS AND RECOMMENDATIONS

- Both PM_{10} samplers passed the flow rate audits.
- The station appeared to be in good working order.
- Both PM_{10} samplers were removed from the site at the end of the 1st Quarter 2005.

4.0 REFERENCES

State of Alaska. Alaska Department of Environmental Conservation. State of Alaska Quality Assurance Manual for Ambient Air Quality Monitoring. Juneau, AK: ADEC, 1996.

United States. Environmental Protection Agency. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA-450/4-87-007. Research Triangle Park, NC: OAQPS, 1987.

Appendix A
Performance Audit Sheets

PM_{10} Sampler Audit Data Sheet

Rock Creek Air Monitoring Project

Operator W. Dominic Shallies Date/Time of Audit 3/15/05 3:00pm

PM_{10} Sampler: Make/Model BGI PQ100 S/N 374

Type of sampler (circle one): [Primary] Co-located

Flow Check Device BIOS DryCal DC-Lite DCL-MH Flow Transfer Standard

S/N 6402 Calibration Date 10/27/04

Ambient Temp 1.55 °C Ambient Press 997 mb

Flow Transfer Standard Flow Rate	17.40 L/min
Sampler Indicated Flow Rate	16.70 L/min
Sampler Design Flow Rate	16.67 L/min

% Difference of Sampler from Transfer Standard QC Flow Rate	4.02 %
% Difference of Transfer Standard Flow Rate from Design Flow Rate	4.38 %

Comments:

PM_{10} Sampler Audit Data Sheet

Rock Creek Air Monitoring Project

Operator W. Dominic Shallies Date/Time of Audit 3/15/05 3:15pm

PM_{10} Sampler: Make/Model BGI PQ100 S/N 373

Type of sampler (circle one): Primary (Co-located)

Flow Check Device BIOS DryCal DC-Lite DCL-MH Flow Transfer Standard

S/N 6402 Calibration Date 10/27/04

Ambient Temp 1.55 °C Ambient Press 997 mb

Flow Transfer Standard Flow Rate	17.46 L/min
Sampler Indicated Flow Rate	16.67 L/min
Sampler Design Flow Rate	16.67 L/min

% Difference of Sampler from Transfer Standard QC Flow Rate	4.52 %
% Difference of Transfer Standard Flow Rate from Design Flow Rate	4.74 %

Comments:

Appendix B
Audit Equipment Certifications

Certificate of Accuracy

Transfer Standard Type: Barometric Pressure/Altimeter

Transfer standard model: Pretel AltiPlus A2
Serial number: 27806
submitted by/owner: Hoefler Consulting Group

Was compared to Precision Absolute Reference Barometer:
Model number: 355-AI0900 Serial number: 913930-M1
Certified accuracy of ± 0.007"Hg
NIST traceable to Ruska Deadweight Tester SN 38342/C-85

Date: 4/17/2004 Lab temperature 71.5 °F
Lab pressure 652.30 mm Hg

Reference barometer ("Hg)	Transfer Standard ("Hg)	Difference from Reference ("Hg)	Transfer Standard Correction* ("Hg)
24.00	24.06	0.06	-0.06
25.68	25.74	0.06	-0.06
26.00	26.06	0.06	-0.06
28.00	28.06	0.06	-0.06
30.00	30.06	0.06	-0.06

Note:
If no sign is given on the correction, the true pressure is higher than the indicated pressure. If the sign is negative, the true pressure is lower than the indicated pressure.

Transfer Standard adjustments made? YES ☐ **NO** ☒
Post-calibration measurements:

Reference barometer ("Hg)	Transfer Standard ("Hg)	Difference from Reference ("Hg)	Transfer Standard Correction* ("Hg)

Reviewed: RLH Date: 4-17-04

Chinook Engineering
a division of Inter-Mountain Laboratories, Inc.
555 Absaraka Street
Sheridan, Wyoming 82801 USA
(307) 672-7790
chinook@imlinc.com

ACCREDITED
Certificate No. 1750.01

Calibration complies with ISO 17025

Cert. No. 4000: 521722

Traceable® Certificate of Calibration for Digital Thermometer

Instrument Identification

Hoefler Consulting Group, 3401 Minnesota Dr., Suite 300, Attn. Chris Lindsey, Anchorage, AK 99503 U.S.A. (RMA:925590)

Model No.15-077-8 S/N 21164797 Manufacturer:Control Company
Probe: 15-077-7 22136783

Standards/Equipment Used	Model	Serial No.	Recall Date	NIST Reference
THERMOMETRICS TEMP PROBE	ES225	149	7/20/2005	A4715024 NVLAP
Hart Scientific 2563 Module	2563	A27129	6/24/2005	1000171514
Hart Precision Bath	7011	93139		

Certificate Information

As Found: Out of Tolerance
As Left: In Tolerance
Procedure: CAL-06

Cal Date: 8/11/2004
Due Date: 8/11/2005
Technician: 68

Test Conditions: 24.0°C 47.0 RH 29.88 in Hg

Calibration Data (As Left)

Standard	Reading	Units	Condition
0.001	-0.002	°C	In Tolerance
25.001	25.002	°C	In Tolerance
60.001	59.999	°C	In Tolerance
99.999	100.002	°C	In Tolerance

Accuracy: ±0.05°C (0 to 100°C)
Expanded Measurement Uncertainty at k=2: ± 0.013°C

This Digital Thermometer was calibrated against National Institute of Standards and Technology Traceable Instrumentation.
A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full.

Wallace Berry

Wallace Berry, Technical Manager

Maintaining Accuracy

In our opinion, once calibrated your Digital Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com

ACCREDITED
Certificate #1.9. 0

Calibration complies with ISO 17025

Cert. No.:4000-1033196

Traceable® Certificate of Calibration for Digital Thermometer

Instrument Identification:

Hoefler Consulting Group, 3401 Minnesota Dr., Suite 300, Attn. Chris Lindsey, Anchorage, AK 99503 U.S.A. (RMA:927133)

Model: 15-077-8 S/N: 21164097 Manufacturer : Control Company

Model: 15-077-7 S/N: 21164148

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Probe	128	10/18/05	A4A12029
Thermistor Module	A27129	6/24/05	1000171514
Temperature Calibration Bath	A42238		

Certificate Information:

Technician: 68 Procedure: CAL-06 Cal Date: 1/04/05 **Cal Due: 1/04/06**

Test Conditions: 24.0°C 55.0 %RH 1020 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±uc	TUR
°C	0.001	0.240	N	0.001	-0.001	Y	-0.049	0.051	0.013	3.8:1
°C	25.001	25.136	N	25.001	24.998	Y	24.951	25.051	0.013	3.8:1
°C	59.999	60.086	N	59.999	60.002	Y	59.949	60.049	0.013	3.8:1
°C	99.999	100.096	N	99.999	100.004	Y	99.949	100.049	0.013	3.8:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full.

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Wallace Berry, Technical Manager

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In our opinion once calibrated your Digital Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Bios International Calibration Certificate

Report No. 29523
Product DCL-MH
Serial No. 6402
Cal. Date 27 October 2004
Cal due. 26 October 2005

Hoefler Consulting Group
3401 Minnesota Drive
Anchorage AK 99503
Acct. No. HOECON
PO No. Visa

As Received Test Data

Calibration Standards Used

All units tested in accordance with Bios International Corporation test number PR05-2 Rev B or PR01-10 Rev D using high-purity bottled nitrogen.

Asset Number	Description	Cal Date	Due Date
ML-500-10 102175	ML-500 Low Flow Cell	4/30/2004	4/30/2005
ML-500-44 100392	ML-500 High Flow Cell	11/19/2003	11/19/2004

Technician Sonia Otero
Lab. Pressure 753.6 mmHg
Lab. Temperature 21.9 °C

Instrument Reading (ml/min)	Lab Standard Reading (ml/min)	Lab Standard Unit No.	Deviation	Allowable Deviation	Condition Shipped
202.1	200.2	102175	0.95 %	1.00%	in tolerance
5037	5008.5	100392	0.57 %	1.00%	in tolerance
17100	17005	100392	0.56 %	1.00%	in tolerance

The allowable deviation consists of the RSS of the expanded uncertainties of the working standards (0.25%), experimental errors (0.25%), and the error of the device under test (DUT), which is the remainder of the allowable deviation.

As Shipped Test Data

Calibration Standards Used

All units tested in accordance with Bios International Corporation test number PR05-2 Rev B or PR01-10 Rev D using high-purity bottled nitrogen.

Asset Number	Description	Cal Date	Due Date
ML-500-10 101137	ML-500 Low Flow Cell	10/13/2004	10/13/2005
ML-500-44 100392	ML-500 High Flow Cell	11/19/2003	11/19/2004

Technician Sonia Otero
Lab. Pressure 753.7 mmHg
Lab. Temperature 22 °C

Instrument Reading (ml/min)	Lab Standard Reading (ml/min)	Lab Standard Unit No.	Deviation	Allowable Deviation	Condition Shipped
200.6	200.35	101137	0.12 %	1.00%	in tolerance
5014	5000.5	100392	0.27 %	1.00%	in tolerance
17070	17050	100392	0.12 %	1.00%	in tolerance

The allowable deviation consists of the RSS of the expanded uncertainties of the working standards (0.25%), experimental errors (0.25%), and the error of the device under test (DUT), which is the remainder of the allowable deviation.

Each DryCal flow calibrator is dynamically tested by comparing it to a laboratory standard primary piston prover of much higher accuracy (±0.25% or better) but of similar operating principles. Flow generators of ±0.03% stability are used for the comparison. Use of provers of similar construction to the device under test assures the validity of the flow generator as a transfer standard. The primary laboratory standards are qualified by direct measurement of their dimensions (diameter, length of measured path, time base) against NIST traceable gauges and instruments (NIST numbers available upon request). A rigorous analysis of their accuracy in accordance with the International Guide to Uncertainty in Measurements has been performed, assuring their traceable accuracy. Test procedures ensure temperature matching of the laboratory standards and the device under test.

Bios International Corporation
10 Park Place, Butler, NJ 07405 USA
www.biosint.com

Printed 27 October 2004

Bios International Calibration Certificate

Report No. 29523
Product DCL-MH
Serial No. 6402
Cal. Date 27 October 2004
Cal due. 26 October 2005

Hoefler Consulting Group
3401 Minnesota Drive
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PO No. Visa

Harvey Padden, President