for **Peabody Midwest Mining LLC**
Bear Run Mine
Carlisle, Indiana

First Monitoring Month
June 14 – July 13, 2012
Particulate & Meteorological Monitoring Summary
Bear Run Mine

July 27, 2012
MMA Project Number 2507-11

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Table of Contents

Section		Page
1.0	**Introduction**	**1**
2.0	**Air Quality Station Performance Summary**	**2**
2.1	Notable Project Events	2
2.2	Missing and Invalid Data	2
2.3	Network Data Completeness	2
2.4	Calibrations	3
2.5	Performance Audits	3
2.6	Field Blank	3
3.0	**Air Quality Monitoring Data Summary**	**4**
4.0	**Meteorological Station Performance Summary**	**7**
4.1	Notable Project Events	7
4.2	Missing and Invalid Data	7
4.3	Network Data Completeness	7
4.4	Quality Control and Quality Assurance	7
4.4.1	Calibrations	7
4.4.2	Performance Audit Results	7
5.0	**Meteorological Monitoring Data Summary**	**9**
5.1	Wind Analysis by Hour of the Day	9
5.2	Temperature Data	9
5.3	Barometric Pressure Data	9
5.4	Precipitation Data	9
6.0	**Conclusions**	**13**

List of Figures ..... **Page**

Number	Title	
5-1	Bear Run Mine, Site 3 Meteorological Station, June 14 – July 13, 2012 Wind Rose (Graphical Wind Frequency Distribution)	12

List of Tables

Number	Title	Page
2-1	Missing Particulate Data, Bear Run Mine, June 14 – July 13, 2012	2
2-2	Data Recovery Rates, Bear Run Mine, June 14 – July 13, 2012	3
3-1	Airborne PM_{10} Concentrations, Bear Run Mine, June 14 – July 13, 2012	4
3-2	PM_{10} Particulate Filter Data Log, Site 1 – Tisch FRM Sampler Bear Run Mine, June 14 – July 13, 2012	5
3-3	Daily PM_{10} Concentrations Measured by the BAMs, Bear Run Mine, June 14 – July 13, 2012	6
4-1	Data Recovery Rates, Bear Run Mine Meteorological Station, June 14 – July 13, 2012	8
5-1	10-Meter Wind Data Analysis from 6/14/2012 through 7/13/2012 (Frequency of Occurrence of Wind Speed by Direction)	10
5-2	Monthly Temperature Extremes - 2 Meter Level, Bear Run Mine Meteorological Station, June 14 – July 13, 2012	11
5-3	Precipitation Data Summary, Bear Run Mine Meteorological Station, June 14 – July 13, 2012	11

Appendices

Letter	Title
A	Hourly Meteorological Data Listings
B	PM_{10} Calibrations
C	Certificates of Calibration - PM_{10} Flow Rate Calibration Devices
D	Performance Audit Report: June 19, 2012
E	PM_{10} Field Blank for Tisch FRM Sampler
F	Meteorological Calibrations
G	Certificates of Calibration – Meteorological Instrument Calibration Devices

1.0 Introduction

Consistent with the Dust Monitoring Plan (DMP) approved by U.S. EPA Region V pursuant to the Agency's Section 114(a) request for information, dated November 17, 2011, Peabody Midwest Mining, LLC (PMM) is submitting this report documenting PM_{10} and meteorological monitoring for the period from June 14 through July 13, 2012 at PMM's Bear Run Mine. PM_{10} data are provided in Section 3 while meteorological data are provided in Appendix A. PMM commenced monitoring of PM_{10} on June 14, 2012.

Air quality and meteorological data are being collected at the sampling locations in the project area depicted in Figure 1 in the DMP. Continuous PM_{10} beta attenuation monitors (BAMs) collect data at three sites identified as 1, 2, and 3. A Tisch federal reference method (FRM) PM_{10} sampler also operates at Site 1. Meteorological monitoring instrumentation is located at Site 3. The locations of these sites are shown in Figure 1 in the DMP.

2.0 Air Quality Station Performance Summary

2.1 Notable Project Events

PM_{10} monitoring and data collection proceeded smoothly during the initial monitoring month. The PM10 samplers were audited on June 19. On July 8, an area-wide power outage occurred for approximately three hours resulting in the July 8 sample collected on the Tisch sampler to be invalidated. A make up sample was collected on July 11.

2.2 Missing and Invalid Data

The one issue resulting in missing and invalid data for the Site 1 Tisch FRM PM_{10} sampler is listed in Table 2-1.

Table 2-1
Missing Particulate Data
Bear Run Mine
June 14 - July 13, 2012

Date	Problem Encountered	Missing Data/ Dates
7/8/12	Power loss for approximately three hours. Power service resumed at 1700 EST.	Tisch FRM sample on 7/8/12

2.3 Network Data Completeness

Data recovery for the Tisch FRM sampler was 80.0% for samples collected on the national 1-in-6 day schedule. When the make up sample is included, the monthly data recovery for the Tisch FRM sampler becomes 83.3%. Monthly data recovery rates for the BAM PM_{10} units at Sites 1, 2, and 3 were each 100.0%. These data recoveries for this reporting period exceed the 75% standard for particulate sample collection listed in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, US Environmental Protection Agency, EPA-454/B-08-003.

Table 2-2

Data Recovery Rates

Bear Run Mine
June 14 - July 13, 2012

Sampler	Monthly Data Recovery (%)
Tisch PM_{10} Sampler Site 1	80.0 (83.3*)
BAM PM_{10} Monitor Site 1	100.0
BAM PM_{10} Monitor Site 2	100.0
BAM PM_{10} Monitor Site 3	100.0

* Includes make up sample collected July 11.

2.4 Calibrations

Initial calibrations of the Tisch FRM sampler and timer were completed from June 10 through 14. Initial calibrations of the Site 1, Site 2, and Site 3 BAM PM_{10} units were completed on June 9.

Calibration results are provided in Appendix B. Certificates of calibration for the devices used to calibrate the PM_{10} monitor flow rates are presented in Appendix C.

2.5 Performance Audits

Performance audits of the BAM and Tisch PM_{10} instruments were completed on June 19, 2012. Audit results demonstrated that all the PM_{10} instruments were functioning within EPA and manufacturer specifications. Appendix D contains the performance audit report.

2.6 Field Blank

The results of the monthly field blank for the Tisch FRM PM_{10} sampler are provided in Appendix E.

3.0 Air Quality Monitoring Data Summary

The highest 24-hour average PM_{10} concentration for the monitoring period was 94 μg/std.m^3, measured on June 29 at Site 1 by the BAM instrument. The second highest 24-hour average PM_{10} concentration of 88 μg/std.m^3, was measured on June 29 at Site 2 and again on July 5 at the Site 1 BAM. The 24-hour National Ambient Air Quality Standard (NAAQS) for PM_{10} is 150 μg/std.m^3.

The average measured concentrations for the monitoring month for the Tisch FRM sampler at Site 1 was 36.6 μg/std.m^3. The average measured concentrations for the monitoring month for BAM instruments at Sites 1, 2, and 3 were 49.0 μg/std.m^3, 43.6 μg/std.m^3, and 42.5 μg/std.m^3, respectively. PM_{10} concentrations for the monitoring month are summarized in Table 3-1.

PM_{10} concentrations results for the Tisch FRM sampler are presented in Table 3-2. Average daily PM_{10} concentrations for each BAM instrument are presented by month in Table 3-3. All daily PM_{10} concentrations were calculated from measurements taken from midnight to midnight local standard time.

Table 3-1
Airborne PM_{10} Concentrations
Bear Run Mine
June 14 - July 13, 2012

Site/Monitor	Highest 24-Hour Concentration (μg/std.m^3)	Percent of NAAQS*	2nd Highest 24-Hour Concentration (μg/std.m^3)	Percent of NAAQS*	Monthly Mean Concentration (μg/std.m^3)
Site 1 Tisch	46	30.7	38	25.3	36.6
Site 1 BAM	94	62.7	88	58.7	49.0
Site 2 BAM	88	58.7	86	57.3	43.6
Site 3 BAM	68	45.3	67	44.7	42.5

* NAAQS = National Ambient Air Quality Standards. The 24-hour standard for PM_{10} is 150 μg/std.m^3.

Table 3-2
BEAR RUN MINE
Project # 2507-11

PM_{10} Particulate Filter Data Log

Site 1 – Tisch FRM Sampler

Monitoring Month June 14 - July 13, 2012

Completed: 7/25/12

Calibration Dates And Results:			06/14/2012, m= 7.4605, b= 0.4715										
Sample Date	Filter No.	Manometer Average (in. H2O)	Avg. Ambient Temp. (K)	Avg. Ambient Press. (mm Hg)	P1/Pav	Qa (act. m^3/min)	Qstd (std. m^3/min)	Sample Time (min.)	Std. Volume (std.m^3)	Tare Weight (g)	Gross Weight (g)	Net Weight (mg)	Std. PM10 Concen. (ug/std.m^3)
6/14/2012	273701	18.12	296.2	749.00	0.955	1.115	1.106	1437.0	1589	4.6173	4.6663	49.0	31
6/20/2012	273702	20.24	301.2	749.00	0.950	1.112	1.084	1440.6	1562	4.5872	4.6593	72.1	46
6/26/2012	273703	19.39	295.6	747.00	0.952	1.106	1.096	1440.6	1579	4.6150	4.6744	59.4	38
7/2/2012	273705	19.59	301.1	747.00	0.951	1.115	1.085	1440.6	1563	4.6098	4.6687	58.9	38
7/8/2012	273706	18.45	300.2	746.00	0.954	1.120	1.092	1274.4	-----	4.5993	-----	-----	-----
7/11/2012	273707	21.46	300.7	748.00	0.946	1.104	1.077	1441.2	1552	4.5985	4.6450	46.5	30

Comments: Sample collected on July 8 invalid as runtime outside the allowable range of 24 hours +/- 60 minutes due to area wide power outage
Sample collected on July 11 as make up run for July 8
Temperature and barometric pressure data obtained from Site 1 BAM

Table 3-3
Daily PM_{10} Concentrations Measured by the BAMs
Bear Run Mine
June 14 - July 13, 2012

Date	Site 1 24 hr. avg. ($\mu g/std.m^3$)	Site 2 24 hr. avg. ($\mu g/std.m^3$)	Site 3 24 hr. avg. ($\mu g/std.m^3$)
6/14	40	22	60
6/15	44	36	62
6/16	39	46	45
6/17	40	51	35
6/18	57	60	67
6/19	42	51	45
6/20	59	54	55
6/21	53	76	34
6/22	34	15	14
6/23	39	19	29
6/24	65	27	68
6/25	45	21	24
6/26	40	17	31
6/27	54	52	52
6/28	84	86	44
6/29	94	88	55
6/30	56	42	46
7/1	55	43	45
7/2	47	58	38
7/3	33	62	45
7/4	54	66	59
7/5	88	69	42
7/6	84	55	45
7/7	66	44	57
7/8	30	28	28
7/9	26	26	21
7/10	29	25	24
7/11	33	26	33
7/12	22	28	51
7/13	21	15	20

4.0 Meteorological Station Performance Summary

4.1 Notable Project Events

Meteorological monitoring and data collection proceeded normally during the monitoring month. Performance audits were completed on June 19.

4.2 Missing and Invalid Data

The parameters of wind speed, wind direction, and temperature are missing one hour of data collection on June 19 due to the required audit.

4.3 Network Data Completeness

Data recoveries for this reporting period exceed the 90% standard (Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Version 2.0 (Final) US Environmental Protection Agency, EPA-454/B-08-002, March 2008), with perfect recovery rates of 100.0% for each parameter. Data recoveries for the reporting period are summarized in Table 4-1.

4.4 Quality Control and Quality Assurance

4.4.1 Calibrations

Start up calibrations on the meteorological instruments were completed on June 5, 6, and 10. Calibration results are provided in Appendix F. Certificates of calibration for the devices used to calibrate the meteorological instrumentation are presented in Appendix G.

4.4.2 Performance Audit Results

On June 19, performance audits for the wind speed, wind direction, 2-meter temperature, precipitation, and barometric pressure sensors were completed. Audit results for all sensors were passing. The performance audit report is provided in Appendix D.

Table 4-1

Data Recovery Rates
Bear Run Mine Meteorological Station
June 14 through July 13, 2012

Parameter	June 14 - July 13		Monthly Data Recovery Rate (%)	Required Data Recovery Rate (%)
	Valid Hours	Possible Valid		
Wind Speed	719	719	100.0	90.0
Wind Direction	719	719	100.0	90.0
Temperature 2-meter level	719	719	100.0	90.0
Barometric Pressure	720	720	100.0	90.0
Precipitation	720	720	100.0	90.0

5.0 Meteorological Monitoring Data Summary

5.1 Wind Analysis by Hour of the Day

For the reporting period, the standard wind frequency distribution is presented graphically in Figure 5-1 and in tabular form in Table 5-1. The predominant wind direction for the period was from the south, occurring 15.3 percent of the time. The secondary maximum was from the south-southwest occurring 10.7 percent of the time. (Note: the commercial software used to produce graphs uses a starting wind speed threshold different than that of the project wind sensors.)

The mean wind speed for the monitoring period was 5.7 miles per hour (mph) as shown in Table 5-1 (or 2.6 meters per second as shown in Figure 5-1). The direction with the highest mean wind speed of 8.2 mph was south-southwest, while the lowest mean wind speed of 4.5 mph was measured for winds from the south-southeast.

5.2 Temperature Data

The maximum hourly average temperature for the monitoring period of 103.5°F was recorded for hour 1700 EST on June 28. The minimum hourly average temperature for the monitoring period was 56.6°F measured on June 26 for hour 0600 EST. The maximum, minimum, and average values for the month ambient temperature are shown in Table 5-2.

5.3 Barometric Pressure Data

The mean barometric pressure for the monitoring period was 29.36 inches of mercury.

5.4 Precipitation Data

During the monitoring month, 0.67 inches of precipitation were measured. The day with the greatest measured precipitation was July 8 with 0.67 inches recorded. The maximum amount of precipitation received for a one-hour period was 0.19 inches, which occurred during hour 1700 EST on July 8. The precipitation data for the monitoring period are summarized in Table 5-3.

Table 5-1

10 Meter Wind Data Analysis
From 6/14/2012 Through 7/13/2012
Bear Run Mine Meteorological Station

Frequency Of Occurrence Of Wind Speed By Direction

	+----------WIND SPEED CLASSES (MPH)----------+							
DIR	0.0-4.0	4.0-7.4	7.4-12.1	12.1 18.8	18.8 24.6	> 24.6	TOTAL	AVERAGE WIND SPEED
N	.0057	.0209	.0014	.0000	.0000	.0000	0.028	4.7
NNE	.0112	.0223	.0097	.0028	.0000	.0000	0.046	6.5
NE	.0322	.0167	.0125	.0000	.0000	.0000	0.061	4.7
ENE	.0281	.0389	.0056	.0000	.0000	.0000	0.073	4.6
E	.0141	.0515	.0111	.0000	.0000	.0000	0.077	5.5
ESE	.0226	.0682	.0097	.0000	.0000	.0000	0.100	5.0
SE	.0127	.0320	.0014	.0000	.0000	.0000	0.046	4.6
SSE	.0183	.0292	.0028	.0000	.0000	.0000	0.050	4.5
S	.0324	.0904	.0264	.0042	.0000	.0000	0.153	5.8
SSW	.0127	.0376	.0376	.0195	.0000	.0000	0.107	8.2
SW	.0168	.0111	.0236	.0028	.0000	.0000	0.054	6.9
WSW	.0126	.0125	.0139	.0083	.0000	.0000	0.047	7.2
W	.0098	.0139	.0070	.0014	.0000	.0000	0.032	5.6
WNW	.0168	.0139	.0070	.0000	.0000	.0000	0.038	4.9
NW	.0168	.0181	.0070	.0014	.0000	.0000	0.043	5.6
NNW	.0154	.0195	.0083	.0000	.0000	.0000	0.043	5.1
TOT:	0.278	0.497	0.185	0.040	0.000	0.000	1.000	
AVG:	2.8	5.4	9.3	13.7	0.0	0.0		5.7

Total Number of Valid Readings For This Table => 719
Out of 719 Total Valid Hours
Total Number of Missing Hours => 1
Total Number of Calm Hours => 2

Table 5-2
Monthly Temperature Extremes - 2-Meter Level
Bear Run Mine Meteorological Station
June 14 through July 13, 2012

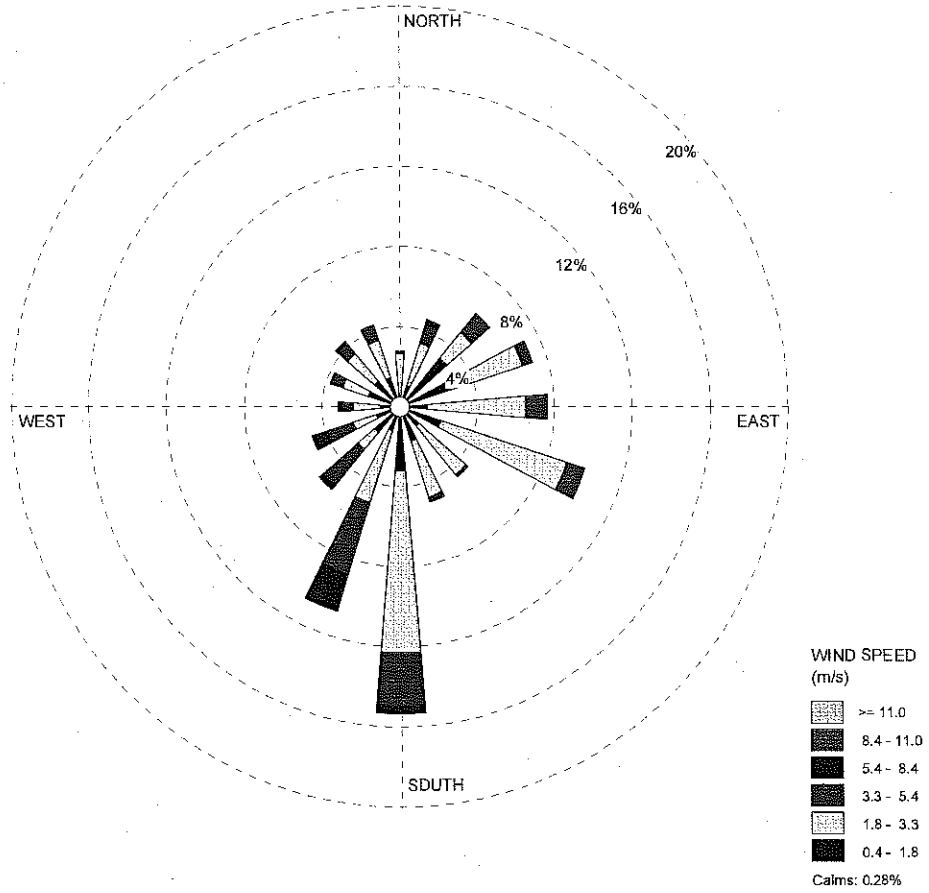
Maximum Hourly Average (°F)	Mean Daily Maximum (°F)	Minimum Hourly Average (°F)	Mean Daily Minimum (°F)	Mean (°F)
103.5	93.2	56.6	68.2	80.9
Maximum hourly average temperature of 103.5°F recorded on June 28 for hour 1700 EST.				
Minimum hourly average temperature of 56.6°F recorded on June 26 for hour 0600 EST.				

Table 5-3
Precipitation Data Summary
Bear Run Mine Meteorological Station
June 14 through July 13, 2012

1-Hour Maximum (inches)	Daily Maximum (inches)	Total for Monitoring Period (inches)
0.19	0.67	0.67

Bear Run Mine
Site 3 Meteorological Data

DISPLAY:
Wind Speed
Direction (blowing from)



DATA PERIOD: 2012 Jun 14 - Jul 13 00:00 - 23:00	COMPANY NAME: Peabody Energy	
	MODELER: McVehil-Monnett Associates	Figure 5-1
CALM WINDS: 0.28%	TOTAL COUNT: 719 hrs.	
AVG. WIND SPEED: 2.56 m/s	DATE: 7/27/2012	PROJECT NUMBER: 2507-11

WRPLOT View - Lakes Environmental Software

6.0 Conclusions

This document summarizes the results for the first month of the Bear Run Mine air quality and meteorological monitoring program.

All PM_{10} concentrations measured were well below the requisite NAAQS. Particulate monitoring data recovery rates for the monitoring month were 83.3% for the Tisch FRM sampler and 100% for each of the BAM instruments.

Meteorological data recovery rates for were 100.0% for all meteorological parameters at the Site 3 meteorological station.

Appendix A
Hourly Meteorological Data Listings

Bear Run Mine
Site 3 Meteorological Station
June 2012

10-Meter Level Hourly Horizontal Wind Speed (mph)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MAX	MIN	MEAN
1																											
2																											
3																											
4																											
5																											
6																											
7																											
8																											
9																											
10																											
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13																											
14	5.5	5.0	3.4	4.5	5.8	5.3	6.2	7.2	7.3	6.9	5.9	6.1	6.3	6.5	6.4	6.3	5.6	5.5	5.0	4.1	4.1	4.7	5.2	4.3	7.3	3.4	5.5
15	4.0	2.6	3.2	2.9	2.8	3.9	4.7	5.4	5.6	5.5	4.9	3.9	4.3	5.2	3.4	4.2	4.5	4.7	3.3	3.3	4.1	5.0	4.8	4.6	5.6	2.6	4.2
16	3.5	4.7	5.6	4.8	4.3	5.2	5.4	6.6	8.5	8.0	10.1	11.2	11.5	11.3	9.9	11.9	12.8	12.3	10.5	7.5	6.1	6.0	4.8	5.9	12.8	3.5	7.8
17	7.8	11.1	10.7	5.8	4.0	2.9	4.3	6.0	8.2	9.2	10.0	10.3	9.4	9.4	8.1	8.6	10.0	9.6	9.2	7.3	4.8	4.2	5.8	6.9	11.1	2.9	7.7
18	5.7	5.0	5.0	4.9	5.4	6.7	6.0	8.8	11.5	13.2	13.1	13.9	15.5	15.7	15.1	16.7	15.4	15.2	15.6	12.5	7.2	6.5	5.5	5.2	16.7	4.9	10.2
19	4.8	5.2	5.3	5.9	5.8	6.5	6.7	7.9	11.3	11.3	11.5	11.7	12.7	12.5	AUD	13.3	13.2	11.6	10.0	7.1	5.5	5.0	5.0	4.3	13.3	4.3	8.4
20	4.2	4.9	4.8	5.2	5.0	5.0	5.4	6.3	7.7	9.0	10.7	10.7	10.5	11.0	10.1	10.1	9.8	9.3	8.4	6.6	4.0	4.4	5.0	5.2	11.0	4.0	7.2
21	4.6	4.8	4.5	4.8	5.1	5.5	6.2	6.9	8.8	10.2	13.6	14.1	11.6	10.7	11.1	12.0	12.6	9.6	9.3	6.5	4.6	2.6	2.8	3.3	14.1	2.6	7.7
22	1.8	1.1	1.6	2.0	2.8	3.6	3.4	4.5	4.4	4.3	5.8	6.1	6.1	6.7	7.3	8.2	7.4	8.2	7.2	6.7	5.4	5.6	4.7	3.6	8.2	1.1	4.9
23	3.9	4.6	1.4	2.6	2.4	2.9	2.9	3.1	5.0	3.7	4.1	6.2	6.4	7.6	5.5	6.1	4.5	3.5	3.2	3.1	3.3	3.3	3.1	2.0	7.6	1.4	3.9
24	2.7	3.0	2.3	1.8	2.6	1.3	2.1	2.2	3.6	5.1	3.7	3.6	5.6	7.2	4.0	3.4	3.4	2.8	4.7	3.5	2.0	1.4	0.5	1.6	7.2	0.5	3.1
25	1.9	3.3	4.0	4.3	3.4	4.3	5.5	9.0	8.8	10.4	10.9	10.9	11.8	11.6	11.8	12.4	12.6	12.1	12.1	8.0	6.4	6.6	6.4	6.1	12.6	1.9	8.1
26	7.1	7.4	6.5	4.7	3.8	3.9	4.7	8.6	8.8	11.0	9.3	9.2	8.8	7.5	9.3	8.6	7.7	6.1	5.9	5.1	4.1	5.2	5.4	4.9	11.0	3.8	6.8
27	4.5	4.1	4.3	4.4	4.4	5.2	4.7	4.2	7.5	8.6	9.5	8.5	9.2	8.9	9.0	8.5	8.6	8.5	7.9	5.2	5.6	5.6	6.0	5.9	9.5	4.1	6.6
28	6.6	5.4	5.2	5.9	5.9	4.8	4.7	5.6	7.7	8.0	10.1	11.3	12.7	13.3	12.9	12.4	12.4	10.4	8.6	6.2	4.7	3.0	4.4	3.7	13.3	3.0	7.7
29	4.2	3.7	2.6	3.5	3.3	3.4	3.1	4.4	4.8	2.9	4.6	5.7	7.7	8.4	9.5	10.7	9.9	8.1	6.1	4.6	3.2	2.6	3.2	4.5	10.7	2.6	5.2
30	3.7	3.9	5.0	3.7	4.6	5.5	7.4	8.6	8.2	6.8	2.7	4.9	7.9	7.5	5.7	7.9	5.9	4.7	4.8	2.8	1.6	4.7	5.6	4.5	8.6	1.6	5.4
MEAN	4.5	4.7	4.4	4.2	4.2	4.5	4.9	6.2	7.5	7.9	8.3	8.7	9.3	9.5	8.7	9.5	9.2	8.4	7.7	5.9	4.5	4.5	4.6	4.5			6.5
MAX	7.8	11.1	10.7	5.9	5.9	6.7	7.4	9.0	11.5	13.2	13.6	14.1	15.5	15.7	15.1	16.7	15.4	15.2	15.6	12.5	7.2	6.6	6.4	6.9	16.7		
MIN	1.8	1.1	1.4	1.8	2.4	1.3	2.1	2.2	3.6	2.9	2.7	3.6	4.3	5.2	3.4	3.4	3.4	2.8	3.2	2.8	1.6	1.4	0.5	1.6		0.5	

AUD = Data missing due to audit

Bear Run Mine
Site 3 Meteorological Station
July 2012

10-Meter Level Hourly Horizontal Wind Speed (mph)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MAX	MIN	MEAN
1	4.3	3.4	1.6	3.6	4.5	3.7	5.1	7.0	4.8	5.6	5.2	5.7	6.3	6.5	5.1	7.5	6.4	6.3	15.9	7.5	6.4	4.9	3.0	1.3	15.9	1.3	5.5
2	2.2	1.9	1.9	2.8	3.2	3.4	3.5	4.5	4.4	3.6	3.6	6.4	7.5	5.5	6.6	5.0	4.7	5.1	12.3	8.8	4.2	3.5	10.2	7.8	12.3	1.9	5.1
3	6.2	2.1	4.1	4.1	4.7	5.2	2.9	4.0	5.3	5.5	5.0	4.8	5.2	5.4	6.7	5.7	6.3	6.6	5.7	4.3	7.4	3.2	3.2	5.6	7.4	2.1	5.0
4	6.5	5.6	5.2	4.7	2.6	3.1	2.6	3.7	4.6	3.5	4.9	4.9	5.4	6.0	7.2	6.9	6.7	8.1	8.5	3.1	2.5	5.1	2.6	2.8	8.5	2.5	4.9
5	3.1	2.9	2.5	1.7	1.5	2.6	2.4	2.9	2.7	3.4	3.0	4.3	7.2	6.0	6.6	7.0	7.1	9.0	7.4	4.6	1.8	3.0	2.0	1.0	9.0	1.0	4.0
6	1.4	1.2	1.7	1.2	2.6	2.2	2.4	0.7	2.3	2.8	3.3	4.7	6.4	6.0	6.5	5.9	5.2	6.0	4.4	2.8	1.4	2.7	2.0	3.6	6.5	0.7	3.3
7	3.1	1.3	1.9	2.2	3.4	1.9	2.0	2.0	1.5	3.1	3.5	4.6	8.5	7.3	4.4	5.1	5.0	3.8	3.1	4.0	5.4	8.8	3.2	4.8	8.8	1.3	3.9
8	4.2	2.6	2.6	4.3	3.4	5.3	5.1	3.7	4.5	3.6	2.7	5.8	7.2	8.7	5.9	9.9	8.4	4.8	4.7	3.4	4.5	5.1	3.2	2.2	9.9	2.2	4.8
9	2.3	1.4	3.3	4.2	4.7	4.9	3.2	5.0	6.6	7.7	8.8	7.4	8.1	6.6	5.4	4.9	5.8	4.6	3.4	2.8	1.9	1.8	2.0	2.6	8.8	1.4	4.5
10	2.5	1.8	2.0	4.7	3.0	3.7	2.9	4.7	5.1	6.1	6.7	7.5	8.0	6.9	5.1	4.6	4.4	2.5	1.9	2.9	5.6	6.4	6.2	6.5	8.0	1.8	4.6
11	7.2	6.4	5.9	5.1	5.0	4.4	4.8	6.0	6.0	5.6	4.7	6.1	6.2	5.4	5.3	5.7	5.5	5.9	5.4	3.6	3.2	4.2	4.4	5.3	7.2	3.2	5.3
12	6.2	5.7	4.6	6.9	4.5	5.2	4.9	4.7	3.5	3.1	2.6	4.1	5.9	7.9	7.5	8.0	8.0	9.0	8.3	5.5	5.9	5.3	3.7	4.4	9.0	2.6	5.6
13	3.7	3.3	4.2	4.5	4.4	2.7	3.1	4.7	4.8	4.5	4.6	6.5	5.9	6.2	6.1	6.6	5.9	5.5	5.3	4.7	3.8	3.5	4.7	5.1	6.6	2.7	4.8
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MEAN	4.1	3.0	3.2	3.9	3.6	3.7	3.4	4.1	4.3	4.5	4.5	5.6	6.8	6.5	6.0	6.4	6.1	5.9	6.6	4.4	4.1	4.4	3.9	4.1			4.7
MAX	7.2	6.4	5.9	6.9	5.0	5.3	5.1	7.0	6.6	7.7	8.8	7.5	8.5	8.7	7.5	9.9	8.4	9.0	15.9	8.8	7.4	8.8	10.2	7.8	15.9		
MIN	1.4	1.2	1.6	1.2	1.5	1.9	2.0	0.7	1.5	2.8	2.6	4.1	5.2	5.4	4.4	4.6	4.4	2.5	1.9	2.8	1.4	1.8	2.0	1.0		0.7	

Bear Run Mine
Site 3 Meteorological Station
June 2012

10-Meter Level Hourly Wind Direction (degrees)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1																								
2																								
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14	91	95	72	69	87	74	82	89	96	117	107	99	102	115	96	110	123	113	111	113	110	107	115	131
15	100	108	59	46	51	79	97	114	142	140	162	170	75	119	138	137	135	120	130	99	98	109	123	127
16	158	151	163	147	147	164	171	182	194	200	221	206	202	208	194	190	198	199	192	179	168	171	176	173
17	184	203	224	217	235	209	225	268	259	261	244	236	232	232	230	235	229	226	201	194	187	184	193	181
18	182	186	184	183	184	184	187	194	206	207	203	194	194	201	200	201	207	203	203	195	181	181	183	177
19	178	172	179	181	172	169	175	182	211	215	220	209	200	187	AUD	181	177	179	176	177	171	152	155	161
20	150	172	174	168	173	168	164	181	199	212	235	213	205	200	193	189	183	192	183	176	175	174	176	182
21	200	210	192	190	179	177	179	192	215	224	230	230	227	231	218	244	310	318	317	342	336	311	299	302
22	291	267	273	279	301	305	321	342	357	350	322	327	316	318	330	329	340	340	334	337	336	351	3	21
23	18	10	39	30	40	46	60	60	77	96	95	56	66	74	78	95	78	120	96	38	46	65	79	93
24	75	119	50	42	80	111	39	105	179	217	247	250	295	304	341	313	287	282	287	293	306	310	346	104
25	39	33	37	1	336	4	19	33	35	39	38	42	27	11	10	17	20	24	20	14	10	19	31	15
26	20	22	36	55	64	66	88	95	95	86	71	47	41	35	36	46	56	66	77	70	77	100	87	84
27	103	113	120	118	114	124	119	137	165	178	179	178	188	185	183	190	197	182	203	180	177	179	178	168
28	181	186	175	179	181	178	186	210	244	248	251	240	256	252	247	252	251	233	238	238	247	230	223	184
29	196	194	216	214	241	272	226	218	264	267	212	243	275	289	266	270	283	284	263	244	278	179	107	68
30	127	122	125	136	32	42	69	102	124	165	191	253	293	306	295	325	350	332	334	336	161	211	40	88

AUD = Data missing due to audit

Bear Run Mine
Site 3 Meteorological Station
July 2012

10-Meter Level Hourly Wind Direction (degrees)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	132	37	65	74	124	123	132	129	135	163	188	191	196	206	263	296	314	317	244	190	111	121	103	195
2	320	35	142	146	152	160	92	102	116	166	188	197	198	182	184	188	213	223	262	319	250	167	187	197
3	213	84	66	138	169	169	172	178	187	210	254	197	175	195	190	201	196	194	188	192	204	188	208	198
4	201	197	188	191	169	166	169	201	221	220	212	232	272	292	272	304	290	260	199	247	201	191	189	188
5	190	190	228	191	230	173	145	184	226	250	199	239	274	313	309	321	314	341	342	341	335	333	351	333
6	257	186	281	338	46	7	66	187	359	326	300	298	298	322	322	331	16	105	191	223	249	283	301	314
7	209	219	313	9	36	42	236	173	152	179	240	270	200	99	4	264	288	308	50	13	301	257	343	102
8	115	182	298	278	312	356	23	61	86	112	123	315	337	332	113	74	122	254	352	344	347	24	14	70
9	326	297	331	356	360	358	18	51	69	85	107	124	119	117	116	118	119	130	151	161	149	196	250	45
10	41	43	62	19	31	38	34	18	44	68	74	81	93	108	98	67	84	77	68	54	38	34	35	28
11	29	28	32	34	29	60	53	85	83	89	79	87	88	84	128	96	88	66	85	73	74	74	69	79
12	76	82	74	99	73	95	96	93	110	128	96	86	102	101	95	105	119	160	129	116	130	167	154	147
13	128	113	113	125	113	102	95	125	141	121	120	109	111	115	120	93	128	102	112	122	122	143	147	152
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Bear Run Mine
Site 3 Meteorological Station
June 2012

2-Meter Level Hourly Temperature (°F)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MAX	MIN	MEAN
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14	66.0	64.8	61.3	59.6	61.4	60.5	62.7	65.8	69.5	73.3	76.5	78.6	80.8	82.3	83.5	84.5	84.9	84.6	83.3	80.2	76.4	72.7	70.4	68.6	84.9	59.6	73.0
15	66.5	65.0	61.5	60.2	58.2	56.9	62.1	68.6	73.9	78.4	81.5	82.9	85.4	87.0	88.5	89.0	89.2	88.0	85.0	81.3	79.0	76.5	75.1	75.3	89.2	56.9	75.6
16	73.8	72.1	72.6	70.7	69.4	69.2	71.5	74.8	78.4	82.3	85.7	88.1	90.0	90.4	91.1	91.8	91.6	90.5	88.7	86.6	83.1	81.7	78.6	77.8	91.8	69.2	81.3
17	77.8	78.5	78.4	76.8	75.1	73.7	73.9	74.7	75.6	77.8	78.8	80.1	81.4	83.0	84.6	85.4	85.7	85.8	84.7	82.3	79.7	78.1	76.3	74.8	85.8	73.7	79.3
18	74.4	73.9	72.5	71.6	71.0	71.2	71.9	75.0	78.0	81.6	84.3	86.0	87.6	89.4	90.7	90.9	90.7	89.4	87.8	85.4	82.1	79.5	77.3	75.6	90.9	71.0	80.7
19	74.5	73.7	72.5	71.7	71.1	70.8	72.0	75.5	80.4	83.3	86.2	87.5	89.5	AUD	91.0	91.8	92.1	90.8	89.8	87.0	82.6	79.4	77.8	76.2	92.1	70.8	81.2
20	75.1	74.1	73.0	71.6	70.6	69.8	72.4	76.4	80.9	85.4	87.8	90.1	91.3	91.9	92.9	92.6	92.4	90.3	90.0	87.0	82.3	78.9	77.2	75.2	92.9	69.8	82.0
21	74.2	73.1	71.3	69.9	69.2	69.2	71.3	75.7	80.5	84.3	87.5	89.6	91.0	91.3	92.2	90.5	84.9	82.2	79.2	77.1	75.6	74.1	72.0	70.1	92.2	69.2	79.0
22	69.2	67.0	65.8	64.3	63.9	63.0	64.3	68.7	73.5	77.9	80.5	82.3	83.3	84.7	85.7	86.1	86.1	85.1	83.4	80.6	76.4	73.5	70.3	68.5	86.1	63.0	75.2
23	66.5	62.7	62.3	60.3	60.2	59.6	61.4	70.3	74.9	78.6	80.9	83.1	84.7	87.0	87.2	87.9	87.9	87.1	84.4	82.0	78.7	76.5	74.9	73.3	87.9	59.6	75.5
24	71.8	71.9	68.8	67.4	65.7	66.1	67.4	74.1	79.4	83.1	85.4	85.8	86.7	87.3	86.5	87.2	87.8	88.4	87.5	84.0	80.3	77.1	74.4	73.1	88.4	65.7	78.6
25	73.2	71.7	72.2	73.0	71.6	71.3	73.3	75.1	77.4	80.4	83.5	85.6	87.0	87.8	88.2	87.8	86.9	85.6	83.4	79.5	73.9	69.3	67.1	64.3	88.2	64.3	77.9
26	63.3	61.7	61.1	59.6	57.4	56.6	60.2	64.7	68.2	71.7	74.5	77.1	78.8	80.6	82.3	83.6	84.3	83.4	81.9	78.5	73.5	71.0	68.9	66.5	84.3	56.6	71.2
27	65.6	65.1	64.1	62.8	61.1	60.5	62.4	69.2	74.0	77.2	80.2	82.1	84.5	86.6	88.5	90.0	90.8	90.4	89.0	84.8	80.4	77.5	75.7	74.6	90.8	60.5	76.5
28	72.5	71.3	71.2	70.6	69.7	69.1	70.3	74.2	79.1	84.4	89.9	94.6	97.2	99.2	101.2	102.9	103.5	102.9	100.4	95.5	91.0	87.7	84.2	78.2	103.5	69.1	85.9
29	78.9	76.5	77.0	75.0	74.6	75.4	73.9	78.3	83.1	87.9	92.6	96.2	99.3	101.5	102.8	103.4	102.6	101.4	99.2	94.8	90.4	82.7	80.2	78.2	103.4	73.9	87.7
30	78.7	77.2	76.5	75.2	74.0	73.5	75.7	78.0	81.1	85.5	88.1	91.9	95.2	96.2	96.6	97.3	96.2	96.1	95.1	91.4	86.2	82.2	82.3	82.3	97.3	73.5	85.5
MEAN	71.9	70.6	69.5	68.2	67.3	66.9	68.6	72.9	76.9	80.8	83.7	86.0	87.9	89.1	90.2	90.7	90.4	89.5	87.8	84.6	80.7	77.6	75.5	73.7			79.2
MAX	78.9	78.5	78.4	76.8	75.1	75.4	75.7	78.3	83.1	87.9	92.6	96.2	99.3	101.5	102.8	103.4	103.5	102.9	100.4	95.5	91.0	87.7	84.2	82.3	103.5		
MIN	63.3	61.7	61.1	59.6	57.4	56.6	60.2	64.7	68.2	71.7	74.5	77.1	78.8	80.6	82.3	83.6	84.3	82.2	79.2	77.1	73.5	69.3	67.1	64.3		56.6	

AUD = Data missing due to audit

Mean Daily Maximum = 91.2
Mean Daily Minimum = 66.3

Bear Run Mine
Site 3 Meteorological Station
July 2012

2-Meter Level Hourly Temperature (°F)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MAX	MIN	MEAN
1	81.9	79.1	77.7	75.7	76.5	76.9	77.4	80.0	83.9	87.5	90.3	93.0	95.3	98.5	99.4	100.0	100.2	99.4	87.7	80.3	76.2	73.8	72.1	71.1	100.2	71.1	84.7
2	69.4	68.1	67.5	67.8	68.3	69.1	70.7	74.4	78.7	83.3	87.6	90.0	92.4	94.8	95.9	96.3	96.3	93.7	84.6	81.3	80.5	77.8	77.7	76.5	96.3	67.5	80.9
3	75.5	72.5	69.4	69.3	68.8	70.0	72.1	75.0	78.8	82.1	85.0	87.5	89.5	91.2	92.9	93.9	94.4	94.2	92.9	90.1	86.4	82.0	79.7	77.1	94.4	68.8	82.1
4	76.9	75.4	74.3	73.5	73.0	72.6	74.8	78.3	82.2	85.6	89.6	93.2	96.6	98.5	99.6	100.2	99.9	96.2	91.8	89.4	85.8	83.0	81.1	79.4	100.2	72.6	85.5
5	78.3	77.0	76.4	74.2	74.0	71.9	74.6	79.8	84.5	89.6	93.4	97.8	100.0	101.4	102.1	102.7	102.8	101.7	99.8	95.7	91.4	88.9	85.9	83.0	102.8	71.9	88.6
6	79.9	79.4	78.4	77.6	76.5	76.3	78.7	83.7	87.6	91.5	94.7	97.7	99.7	100.7	101.6	102.6	102.0	100.5	98.0	94.8	90.7	88.7	86.7	86.2	102.6	76.3	89.8
7	81.8	80.7	79.6	78.7	78.5	78.8	78.6	83.3	88.8	94.0	96.7	97.9	92.5	96.5	101.6	102.0	102.9	102.0	100.6	94.9	90.1	89.9	87.4	85.8	102.9	78.5	90.1
8	86.7	85.0	81.8	80.2	79.0	79.9	79.5	81.7	85.1	89.0	91.8	93.9	95.4	93.8	81.3	75.2	72.8	72.6	72.5	72.9	73.1	73.4	73.1	72.3	95.4	72.3	80.9
9	71.7	71.2	71.0	70.0	69.5	68.6	69.8	73.3	76.9	79.2	81.7	82.3	83.3	84.9	85.9	86.5	87.2	87.3	86.4	84.1	80.8	75.7	73.9	71.9	87.3	68.6	78.0
10	71.3	70.4	69.4	68.5	68.1	66.8	68.5	71.8	77.3	82.3	85.7	87.9	89.3	90.5	91.1	91.8	90.2	89.2	87.6	84.0	80.7	78.1	77.1	74.7	91.8	66.8	79.7
11	73.7	71.8	69.8	67.9	66.3	66.2	68.3	73.2	77.0	79.9	83.9	87.3	89.6	91.0	91.5	92.3	91.2	91.4	89.4	86.0	83.0	79.3	76.7	76.5	92.3	66.2	80.1
12	76.1	74.5	72.1	73.0	70.2	70.2	71.3	74.8	78.0	81.4	84.4	87.5	89.9	91.3	92.1	92.7	92.2	90.1	88.3	85.7	82.3	79.5	77.3	75.0	92.7	70.2	81.2
13	73.2	71.7	70.9	70.0	69.4	68.8	69.8	72.7	75.8	78.1	80.3	82.8	84.5	86.4	87.3	88.0	87.0	87.2	86.9	84.7	81.0	79.0	77.7	77.0	88.0	68.8	78.8
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MEAN	76.6	75.1	73.7	72.8	72.2	72.0	73.4	77.1	81.1	84.9	88.1	90.7	92.2	93.8	94.0	94.2	93.8	92.7	89.7	86.4	83.2	80.7	79.0	77.4			83.1
MAX	86.7	85.0	81.8	80.2	79.0	79.9	79.5	83.7	88.8	94.0	96.7	97.9	100.0	101.4	102.1	102.7	102.9	102.0	100.6	95.7	91.4	89.9	87.4	86.2	102.9		
MIN	69.4	68.1	67.5	67.8	66.3	66.2	68.3	71.8	75.8	78.1	80.3	82.3	83.3	84.9	81.3	75.2	72.8	72.6	72.5	72.9	73.1	73.4	72.1	71.1		66.2	

Mean Daily Maximum = 95.9
Mean Daily Minimum = 70.7

Bear Run Mine
Site 3 Meteorological Station
June 2012

Barometric Pressure (inches of mercury)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MAX	MIN	MEAN
1																											
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6																											
7																											
8																											
9																											
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13																											
14	29.43	29.45	29.45	29.45	29.45	29.47	29.49	29.50	29.50	29.50	29.50	29.50	29.49	29.47	29.46	29.46	29.45	29.44	29.43	29.43	29.41	29.40	29.41	29.42	29.50	29.40	29.46
15	29.44	29.45	29.45	29.45	29.46	29.46	29.48	29.49	29.50	29.49	29.48	29.48	29.46	29.45	29.45	29.45	29.43	29.43	29.42	29.42	29.42	29.43	29.44	29.44	29.50	29.42	29.45
16	29.44	29.45	29.44	29.45	29.46	29.48	29.50	29.52	29.51	29.52	29.51	29.49	29.48	29.46	29.44	29.41	29.39	29.37	29.36	29.36	29.36	29.37	29.39	29.39	29.52	29.36	29.44
17	29.38	29.35	29.35	29.34	29.34	29.34	29.36	29.37	29.38	29.37	29.36	29.36	29.34	29.33	29.31	29.29	29.27	29.26	29.27	29.27	29.27	29.27	29.27	29.26	29.38	29.26	29.32
18	29.26	29.25	29.25	29.26	29.27	29.27	29.28	29.30	29.30	29.31	29.31	29.30	29.29	29.29	29.27	29.26	29.26	29.26	29.26	29.26	29.28	29.30	29.32	29.34	29.34	29.25	29.28
19	29.35	29.36	29.36	29.36	29.37	29.39	29.41	29.44	29.45	29.45	29.45	29.46	29.46	29.45	29.43	29.42	29.41	29.40	29.40	29.40	29.41	29.43	29.44	29.45	29.46	29.35	29.41
20	29.45	29.44	29.44	29.44	29.45	29.47	29.49	29.50	29.51	29.52	29.51	29.50	29.49	29.48	29.46	29.43	29.42	29.40	29.39	29.38	29.38	29.38	29.39	29.39	29.52	29.38	29.45
21	29.40	29.41	29.40	29.40	29.41	29.41	29.42	29.42	29.42	29.40	29.39	29.37	29.35	29.33	29.32	29.30	29.31	29.32	29.32	29.32	29.34	29.36	29.37	29.37	29.42	29.30	29.37
22	29.37	29.37	29.36	29.37	29.37	29.37	29.38	29.40	29.40	29.40	29.40	29.39	29.38	29.37	29.36	29.34	29.33	29.33	29.32	29.34	29.35	29.36	29.37	29.37	29.40	29.32	29.37
23	29.37	29.37	29.37	29.38	29.38	29.39	29.40	29.41	29.42	29.42	29.43	29.43	29.42	29.40	29.39	29.38	29.37	29.36	29.35	29.36	29.37	29.38	29.39	29.39	29.43	29.35	29.39
24	29.38	29.38	29.37	29.37	29.37	29.37	29.38	29.38	29.39	29.40	29.40	29.39	29.39	29.37	29.34	29.34	29.32	29.31	29.31	29.31	29.30	29.31	29.31	29.30	29.40	29.30	29.35
25	29.29	29.28	29.28	29.28	29.29	29.30	29.31	29.32	29.33	29.34	29.34	29.33	29.32	29.31	29.30	29.30	29.29	29.29	29.29	29.30	29.30	29.32	29.34	29.35	29.35	29.28	29.31
26	29.35	29.35	29.35	29.36	29.37	29.40	29.41	29.42	29.42	29.41	29.41	29.41	29.41	29.38	29.36	29.34	29.33	29.32	29.32	29.32	29.31	29.32	29.33	29.35	29.42	29.31	29.36
27	29.34	29.34	29.34	29.35	29.36	29.37	29.38	29.41	29.42	29.43	29.43	29.42	29.39	29.37	29.35	29.34	29.33	29.31	29.30	29.29	29.27	29.28	29.28	29.29	29.43	29.27	29.35
28	29.28	29.28	29.28	29.29	29.30	29.31	29.32	29.33	29.34	29.33	29.31	29.29	29.29	29.28	29.27	29.25	29.24	29.23	29.23	29.23	29.24	29.25	29.27	29.28	29.34	29.23	29.28
29	29.27	29.26	29.25	29.25	29.26	29.27	29.28	29.30	29.30	29.29	29.27	29.27	29.27	29.26	29.23	29.22	29.21	29.19	29.19	29.19	29.19	29.19	29.20	29.21	29.30	29.19	29.24
30	29.20	29.20	29.17	29.18	29.22	29.23	29.25	29.24	29.24	29.24	29.25	29.25	29.25	29.24	29.23	29.22	29.23	29.22	29.23	29.24	29.24	29.25	29.27	29.26	29.27	29.17	29.23
MEAN	29.35	29.35	29.35	29.35	29.36	29.37	29.38	29.40	29.40	29.40	29.40	29.39	29.38	29.37	29.35	29.34	29.33	29.32	29.32	29.32	29.32	29.33	29.34	29.34			29.36
MAX	29.45	29.45	29.45	29.45	29.46	29.48	29.50	29.52	29.51	29.52	29.51	29.50	29.49	29.48	29.46	29.46	29.45	29.44	29.43	29.43	29.42	29.43	29.44	29.45	29.52		
MIN	29.20	29.20	29.17	29.18	29.22	29.23	29.25	29.24	29.24	29.24	29.25	29.25	29.25	29.24	29.23	29.22	29.21	29.19	29.19	29.19	29.19	29.19	29.20	29.21		29.17	

Bear Run Mine
Site 3 Meteorological Station
July 2012

Barometric Pressure (inches of mercury)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MAX	MIN	MEAN
1	29.25	29.27	29.27	29.28	29.28	29.29	29.31	29.32	29.34	29.35	29.35	29.35	29.33	29.32	29.32	29.31	29.30	29.27	29.30	29.34	29.35	29.35	29.34	29.34	29.35	29.25	29.31
2	29.34	29.34	29.35	29.36	29.37	29.38	29.39	29.41	29.42	29.41	29.40	29.39	29.39	29.37	29.36	29.33	29.32	29.32	29.34	29.36	29.36	29.37	29.41	29.40	29.42	29.32	29.37
3	29.39	29.36	29.34	29.33	29.35	29.36	29.38	29.38	29.38	29.38	29.37	29.36	29.35	29.33	29.31	29.29	29.28	29.27	29.25	29.26	29.28	29.29	29.30	29.31	29.39	29.25	29.33
4	29.31	29.31	29.31	29.31	29.31	29.32	29.33	29.34	29.35	29.35	29.35	29.34	29.34	29.32	29.30	29.29	29.28	29.28	29.28	29.27	29.29	29.31	29.32	29.33	29.35	29.27	29.31
5	29.34	29.33	29.32	29.33	29.34	29.35	29.36	29.37	29.37	29.37	29.37	29.36	29.35	29.33	29.31	29.30	29.30	29.30	29.30	29.30	29.31	29.32	29.33	29.33	29.37	29.30	29.33
6	29.33	29.33	29.33	29.33	29.34	29.36	29.37	29.38	29.38	29.38	29.38	29.37	29.37	29.36	29.34	29.32	29.31	29.30	29.30	29.30	29.31	29.33	29.35	29.35	29.38	29.30	29.34
7	29.35	29.34	29.33	29.33	29.34	29.35	29.37	29.38	29.38	29.37	29.37	29.36	29.35	29.34	29.32	29.30	29.29	29.28	29.27	29.28	29.31	29.33	29.32	29.32	29.38	29.27	29.33
8	29.33	29.31	29.30	29.31	29.32	29.32	29.34	29.35	29.34	29.34	29.34	29.35	29.33	29.31	29.31	29.33	29.37	29.34	29.35	29.34	29.35	29.37	29.39	29.39	29.39	29.30	29.34
9	29.39	29.39	29.38	29.37	29.37	29.37	29.38	29.39	29.40	29.41	29.42	29.42	29.42	29.40	29.39	29.37	29.35	29.34	29.34	29.34	29.35	29.37	29.38	29.38	29.42	29.34	29.38
10	29.38	29.38	29.39	29.39	29.39	29.39	29.41	29.42	29.42	29.42	29.42	29.42	29.42	29.40	29.38	29.37	29.36	29.36	29.35	29.36	29.37	29.39	29.40	29.41	29.42	29.35	29.39
11	29.42	29.42	29.41	29.42	29.43	29.43	29.44	29.45	29.46	29.46	29.46	29.46	29.45	29.44	29.42	29.40	29.39	29.38	29.38	29.39	29.40	29.41	29.42	29.42	29.46	29.38	29.42
12	29.41	29.41	29.40	29.40	29.41	29.42	29.43	29.44	29.45	29.45	29.45	29.45	29.44	29.43	29.40	29.39	29.38	29.38	29.39	29.39	29.40	29.42	29.44	29.45	29.45	29.38	29.42
13	29.45	29.45	29.45	29.44	29.45	29.45	29.47	29.47	29.47	29.47	29.47	29.48	29.46	29.45	29.43	29.41	29.39	29.38	29.40	29.41	29.42	29.43	29.42	29.43	29.48	29.38	29.44
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30																											
MEAN	29.36	29.36	29.35	29.35	29.36	29.37	29.38	29.39	29.40	29.40	29.40	29.39	29.38	29.37	29.35	29.34	29.33	29.32	29.33	29.33	29.35	29.36	29.37	29.37			29.36
MAX	29.45	29.45	29.45	29.44	29.45	29.45	29.47	29.47	29.47	29.47	29.47	29.48	29.46	29.45	29.43	29.41	29.39	29.38	29.40	29.41	29.42	29.43	29.44	29.45	29.48		
MIN	29.25	29.27	29.27	29.28	29.28	29.29	29.31	29.32	29.34	29.34	29.34	29.34	29.33	29.31	29.30	29.29	29.28	29.27	29.25	29.26	29.28	29.29	29.30	29.31		29.25	

Bear Run Mine
Site 3 Meteorological Station
June 2012

Precipitation (inches of water)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MAX	TOTAL
1																										
2																										
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12																										
13																										
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
MAX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
TOTAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00

Bear Run Mine
Site 3 Meteorological Station
July 2012

Precipitation (inches of water)

DAY/HR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MAX	TOTAL
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	0.18	0.16	0.19	0	0.06	0.01	0	0	0	0	0.19	0.67
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
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MAX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.18	0.16	0.19	0.00	0.06	0.01	0.00	0.00	0.00	0.00	0.19	
TOTAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.18	0.16	0.19	0.00	0.06	0.01	0.00	0.00	0.00	0.00		0.67

Appendix B
PM_{10} Calibrations

Form No. F1400.2
Revision No. Original
Date 5/06
Page 1 of 1

PM_{10} & HIGH VOLUME SAMPLER CALIBRATION WORKSHEET
(For Volumetric-Flow-Controlled Samplers)

Project/Site Location Bear Run Mine / Site 1
Date 6/13/12
Calibrated By Ray Roetman
Sampler No./ID RRM
Motor S/N 1958
Critical Flow Device S/N P6186
Sampler Type (circle one) Hi-Vol PM-10

Site Elevation ~585'
Baro. Press. (P_a)(mm Hg) 747.5
Barometer BGI deltaCal S/N 490
Temp. (T_a):(EC) 25.1 (K) 298.2
Thermometer BGI deltaCal S/N 490
Calibration Orifice S/N 148N
Orifice Certification Date 1/11/12
Orifice Cal. Relationship m= 0.9874 b= +0.005

Setup	ΔH PressureDrop Across Orifice (in. H_2O)	$Q_{a\text{-}int}$ From Orifice Calibration $Q_{a\text{-}int} = [(\Delta H)(T_a/P_a)]^{1/2}$	Q_a(orifice) = (1/m){$Q_{a\text{-}int}$ – b}	(X) $Q_a(orifice)/T_a^{1/2}$	ΔH_{cfd} Pressure Drop as Configured (in H_2O)	(mm Hg)	$P_1 = P_a - \Delta H_{cfd}$ (mm Hg)	(Y) P_1/P_a	$Q_a$sampler $=\{(P_1/P_a - b_s)T_a^{1/2}\}(1/m_s)$ (act m^3/min)
Variable orifice	3.52	1.185	1.195	0.0692	5.02	9.38	738.12	0.987	
	3.42	1.168	1.178	0.0682	7.71	14.40	733.10	0.981	
	3.25	1.139	1.148	0.0665	13.01	24.30	723.20	0.967	
	3.07	1.107	1.116	0.0646	18.03	33.67	713.83	0.955	
	2.83	1.063	1.071	0.0620	26.89	50.22	697.28	0.933	
	2.66	1.030	1.038	0.0601	32.03	59.82	687.68	0.920	
Design (Operating) Condition with filter					19.70	36.79	710.71	0.951	* 1.110
~~2.39 → Not Used~~					~~40.67~~	~~75.96~~	~~671.54~~	~~0.898~~	

Sampler off-line ~1002 to 1011 and 1040 to 1052 EST for calibration

Design flow rate % difference = [Q_a(sampler)*-1.13] x 100 = -1.8%
1.13

m_s = 7.4605
b_s = 0.4715
r = 0.9998

rwm 33 6/15/12

Form No. 2095D.1
Revision No. 2
Date 5/12

BAROMETRIC PRESSURE CALIBRATION FORM

Project Beor Run Min
Date 6/10/12

Site /
Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Site Sensor	M. Tisch	TE-303TP	1401
Data Acquis.	Tisch	TE-303TP	1401
Field Barometer	BGI	deltaCal	490

Field Barometer Certification Date: 3/2/2012

Location of Sensor: In base of Tisch FRM PM10 sampler

I. System Inspection: Cable N/A Sensor New

II. Pre-adjustment System Check

TIME (EST)	Data Logger Reading (mmHg)	Field Cal. Device Reading (mmHg)	Field Cal. Device Reading ( )	Difference (mmHg)
1427	744	744.5		-0.5
1458	744.	745.0		-1.0
1515	745	744.5		+0.5

III. Maintenance and Adjustments

1) If needed, complete maintenance, repairs and/or adjustments as per manufacturer's operation manual.
2) Describe any maintenance, repairs or adjustments in the Comments Section of the form.

IV. Post-adjustment System Check (if necessary)

TIME ( )	Data Logger Reading (of Hg)	Field Cal. Device Reading ( )	Field Cal. Device Reading ( )	Difference ( )
		N/A		

Comments: Completed Tisch calibration procedure (adjustment) prior to field calibration

TEMPERATURE CALIBRATION FORM

Project Bear Run Mine
Site 1
Date/Time 6/13/12 ~~1500~~ 1430 EST
Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Sensor	Tisch Env	TE-303TP	1401
Data Acquisition	Tisch Env	TE-303TP	1401
Ref. Thermometer	Cooper	TC 100A	C306956

System Inspection: Cable Pass Sensor Pass Radiation Shield/Motor N/A (Pass/Fail)
List Weather Conditions (wind, sky cover) Hot, scattered clouds
Sensor Height 1 m

Calibration Point: Ice H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1436	+0.2	0.0	
2	1437	+0.1	0.0	
3	1438	+0.2	0.0	
4	1439	+0.1	0.0	
5	1440	+0.2	0.0	Difference
Average		+0.2	0.0	+0.2 (°C)

Calibration Point: Warm H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1440	21.6	21.7	
2	1441	21.8	21.7	
3	1442	21.7	21.7	
4	1443	21.7	21.7	
5	1444	21.6	21.7	Difference
Average		21.7	21.7	0.0 (°C)

Calibration Point: Hot H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	*1453	44.7	44.6	
2	1454	44.4	44.5	
3	1455	44.4	44.4	
4	1456	44.1	44.2	
5	1457	44.1	44.2	Difference
Average		44.3	44.4	-0.1 (°C)

*delay due to incoming phone call

If needed, perform cleaning and maintenance. Describe any work performed
COMMENTS:

w/cc 6/10/12

Form No. F1400.3
Revision No. Original
Date 5/06
Page 1 of 1

TIMER CALIBRATION LOG
(FOR PM-10 AND HIGH VOLUME PARTICULATE SAMPLERS)

PROJECT Bear Run Mine SITE 1

TECHNICIAN Ray Roetman

SAMPLER (TYPE, MODEL, ID, SERIAL NO.) Tisch TE-6070DV S/N 2170 (Inlet) S/N P 6186 (Volumetric Flow Controller)
ELAPSED TIME INDICATOR (MODEL, SERIAL NO.)

SCHEDULED END DATE/TIME 6/13/12 1200 EST ACTUAL END DATE/TIME 6/13/12 1200 EST FINAL ETI READING 24.00
SCHEDULED START DATE/TIME 6/12/12 1200 EST ACTUAL START DATE/TIME 6/12/12 1200 EST INITIAL ETI READING 0.00
SCHEDULED NET TIME 24 HRS. 00 MIN. ACTUAL NET TIME (a) 24 hrs 00 min ETI NET TIME (b) 24.00

SAMPLER (TYPE, MODEL, ID, SERIAL NO.)
ELAPSED TIME INDICATOR (MODEL, SERIAL NO.)

SCHEDULED END DATE/TIME ACTUAL END DATE/TIME FINAL ETI READING
SCHEDULED START DATE/TIME ACTUAL START DATE/TIME INITIAL ETI READING N/A
SCHEDULED NET TIME 24 HRS. 00 MIN. ACTUAL NET TIME (a) ETI NET TIME (b)

SAMPLER (TYPE, MODEL, ID, SERIAL NO.)
ELAPSED TIME INDICATOR (MODEL, SERIAL NO.)

SCHEDULED END DATE/TIME ACTUAL END DATE/TIME FINAL ETI READING
SCHEDULED START DATE/TIME ACTUAL START DATE/TIME INITIAL ETI READING N/A
SCHEDULED NET TIME 24 HRS. 00 MIN. ACTUAL NET TIME (a) ETI NET TIME (b)

SAMPLER (TYPE, MODEL, ID, SERIAL NO.)
ELAPSED TIME INDICATOR (MODEL, SERIAL NO.)

SCHEDULED END DATE/TIME ACTUAL END DATE/TIME FINAL ETI READING
SCHEDULED START DATE/TIME ACTUAL START DATE/TIME INITIAL ETI READING N/A
SCHEDULED NET TIME 24 HRS. 00 MIN. ACTUAL NET TIME (a) ETI NET TIME (b)

a Should agree to within ±30 min. of 24 hours.
b ETI net time should agree to actual net time to within ±2 minutes.

v my 22 6/13/12

CALIBRATION PROCEDURE & WORKSHEET FOR A MET ONE BAM-1020 PM_{10} MONITOR
(Using a BGI deltaCal)

Project: Bear Run Mine Site: 1
Technician: Ray Roetman Site Elevation: ~ 585'
Date/Time: 6/9/12 0845 EST Start

	Make	Model	S/N
Sampler	Met One	BAM- 1020	N5270
Sampler Thermometer	Met One	BX 596	N5400
Cal Thermometer	BGI	deltaCal	490
Cal Barometer	BGI	deltaCal	490
Cal Flow Device	BGI	deltaCal	490

I. **Leak check:** Make sure pump is off. Remove the inlet head and connect the leak check device (part no. BX-302 or equivalent). From the main menu, go to "TEST" then "TAPE" screen, advance the tape one window. From the main menu go to "TEST" then "PUMP" screen, turn on the pump. Make sure device is set to closed position. After a few seconds, look to see that the flow is below 1.0 LPM. Turn pump off. Remove leak check device.
PASS / FAIL circle one Flow: 0.2 LPM (should be less than 1.0 LPM)

II. **Self test:** From the main menu, go to "TAPE" then "SELF TEST". PASS / FAIL circle one

III. **As Found Calibration:** Connect the NIST-traceable reference flow measurement device. From the main menu, go to "TEST" then "FLOW" screen. Record the temperature and pressure readings in the "As Found" table. Using the "NEXT" hot key, scroll through the Ambient Temperature "AT" field and Barometric Pressure "BP" field. When you get the cursor to the "FLOW 1" field, the pump will start. Let the pump run for five minutes at the point, then record your readings. Repeat this procedure for all three flows.

As Found

	BAM	REFERENCE	% Diff	Difference
Ambient Temperature (AT °C)	See T - calibration form			—
Barometric Pressure (BP mmHg)	See BP calibration form			—
Flow 1 Reading (15.0 LPM)	15.0	14.97	+0.2	
Flow 2 Reading (18.4 LPM)	18.4	18.34	+0.3	
Flow 3 Reading (16.7 LPM)	16.7	16.69	+0.1	

The temperature readings for the BAM and calibration thermometer should agree to within ± 2°C. The barometric pressure readings should agree to within ± 10mmHg. The manufacturer's Operation Manual calibration procedure desires that the sampler and reference flow rates should agree to ±1%. If the readings are outside of these limits, proceed to the "As Left" Calibration in Step IV.

IV. **As Left Calibration:** Following the procedure in Step III, enter the flow calibration screen. Calibrate your temperature and/or pressure if necessary. If you do not need to adjust a parameter, press the "NEXT" hot key to scroll through, and notate "NA" in the appropriate boxes. To calibrate the temperature/pressure, adjust the "STD" field to your reference device reading using the red arrow keys. Hit the "CAL" hot key, both the "BAM" and "STD" reading should now read the same. Record your adjusted values in the "As Left" table.

Hit the "NEXT" hot key to scroll to "FLOW 1", let equilibrate for five minutes; calibrate as necessary. To calibrate, set the "STD" field to your reference device reading and hit the "CAL" hot key. Record your readings in the "As Left" table. Follow this procedure to calibrate the remaining flows as necessary. The "CAL" hot key will only adjust "FLOW 3", and only after you have entered the "STD" for "FLOW 1" and "FLOW 2". This is a three point calibration; all points must be accurate to properly adjust the flow of the BAM.

As Left

	BAM	REFERENCE	% Diff	Difference
Ambient Temperature (AT °C)				
Barometric Pressure (BP mmHg)				
Flow 1 Reading (15.0 LPM)				
Flow 2 Reading (18.4 LPM)				
Flow 3 Reading (16.7 LPM)		N/A		

Hit "EXIT" to return to Main Menu. Leave unit in Main Menu reading "Status: ON"

Record End Time 0943 EST

Comments: Next set up for zero background test to start @ 1000 EST
Background now @ -0.0044 prior to test (Factory Setting)
Set to 0.000 for test
BKGD test 6/9/12 1100 EST → 6/13/12 1000 EST Avg Conc +1.9 ug/m³ = +0.0019 mg/m³
New BKGD constant is -0.0019 mg/m³
CONC TYPE set to ACTUAL
Data collection to commence 6/13/12 @ 1300 EST

Site 1

Date 6/9/12

TEMPERATURE CALIBRATION FORM

Project Bear Run Mine
Date/Time 6/9/12

Site 1
Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Sensor	Met One	BX596	N5400
Data Acquisition	Met One	BAM1020	N5270
Ref. Thermometer	Cooper	TC100A	C306956

System Inspection: Cable New Sensor New Radiation Shield/~~Motor~~ Pass/New (Pass/Fail)
List Weather Conditions (wind, sky cover) Calm, Warm, Partly Cloudy
Sensor Height ~1.7m

Calibration Point: Ice H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	0911	+0.3	0.0	
2	0912	+0.2	0.0	
3	0913	+0.1	0.0	
4	0914	+0.1	0.0	
5	0915	+0.1	0.0	Difference
Average		+0.2	0.0	+0.2 (°C)

Calibration Point: Warm H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	0905	20.9	20.9	
2	0906	20.9	20.9	
3	0907	20.9	21.0	
4	0908	20.9	20.9	
5	0909	20.9	21.0	Difference
Average		20.9	20.9	0.0 (°C)

Calibration Point: Hot H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	0919	45.4	45.6	
2	0920	45.4	45.6	
3	0921	45.3	45.5	
4	0922	45.3	45.4	
5	0923	45.2	45.3	Difference
Average		45.3	45.5	-0.2 (°C)

If needed, perform cleaning and maintenance. Describe any work performed
COMMENTS:

BAROMETRIC PRESSURE CALIBRATION FORM

Project Bear Run Mine
Date 6/9/12

Site 1
Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Site Sensor	Met One	BX 596	N5400
Data Acquis.	Met One	BAM 1020	N5270
Field Barometer	BGI	DeltaCal	490

Field Barometer Certification Date: 3/2/12

Location of Sensor: On BAM Mast - below inlet

I. System Inspection: Cable New Sensor New

II. Pre-adjustment System Check

TIME (EST)	Data Logger Reading (mmHg)	Field Cal. Device Reading (mmHg)	Field Cal. Device Reading ( )	Difference (mmHg)
0846	RR ~~748~~ 746	745.5		0.5
0914	746	746		0
0930	746	746		0

III. Maintenance and Adjustments

1) If needed, complete maintenance, repairs and/or adjustments as per manufacturer's operation manual.
2) Describe any maintenance, repairs or adjustments in the Comments Section of the form.

IV. Post-adjustment System Check (if necessary)

TIME ( )	Data Logger Reading (of Hg)	Field Cal. Device Reading ( )	Field Cal. Device Reading ( )	Difference ( )

Comments:

Met One Instruments, Inc.

1600 Washington Blvd. Grants Pass, OR 97526 (541) 471-7111 www.metone.com

Certificate of Calibration

Model BAM 1020

Beta Attenuation Mass Monitor

BAM 1020 Serial Number: N5270 **Sales Order:**

Calibration Performed By: Tasey Graves **Calibration Date:** 4/18/2012

Final Quality Inspection by: J Henger **Inspection Date:** 5-22-12

Configuration: ☐ PM 10 FEM ☒ PM 2.5 FEM ☐ PM 10-2.5 Coarse FEM ☐ PM 10 EU ☐ PM 2.5 EU

Condition: ☒ New Unit ☐ Demonstration Unit ☐ Repair/Upgrade/Recalibration

The BAM 1020 is designated as a U.S. EPA Federal Equivalent Method (FEM) for PM_{10} and $PM_{2.5}$ continuous particulate monitoring in accordance with 40 CFR Part 53, when equipped with appropriate settings and accessories. Older revision units must be upgraded to the latest specs in order to be $PM_{2.5}$ compatible. See the manual for details.

PM_{10} **EQPM-0798-122** $PM_{2.5}$ **EQPM-0308-170** $PM_{10-2.5}$ **EQPM-0709-185**

Factory Calibration Settings		
Name	**Setting**	**Description**
K	*0.970*	Concentration Slope Multiplier
BKGD	*-0.0044*	Concentration Offset, mg/m^3
ABS	*0.814*	Span Membrane Mass mg/cm^2
µsw	*0.304*	Absorption Coefficient
C_V	*1.029*	Flow Sensor Coefficient of Variability
Q_O	*0.000*	Flow Sensor Zero Correction SLPM

These settings are unit-specific calibration values which have been determined during dynamic testing, and should never be changed without specific instructions from Met One Instruments. See the operation manual. The BKGD background correction value may be field audited and altered.

Other Unit Parameters	
BAM 1020 Firmware:	*3236-5 v3.6.8*
Report Processor Firmware:	*80353-03 V2.1.1*
Panel PC Software:	*N/A*
Beta Source Serial Number:	*TV 452*
Beta Detector Voltage VDC:	*-875*
AC Power Supply Setting:	*120/60*

Concentration Stability Results	
Hourly Sensitivity (σ)	*0.0018*
Hourly Detection Limit (2σ)	*3.6*
24 Hour Detection Limit (2σ/5)	*0.72*

Test and Calibration Standards

Standards	*Model*	*SN*	*Cal Due*
Flow Meter	*DC-HC-1*	*Cell 2251, Base 3432*	*10/7/2012*
MULTIMETER	*189 Multimeter*	*82310054*	*6/8/2012*
BAM	*083D-1-6*	*X6315*	*5/25/2012*
Baro Pressure	*BP 091 (26/32-1)*	*B5817*	*5/2/2013*
BAM-1020 FEM2.5	*BAM-1020 FEM2.5*	*N2402*	*2/10/2013*

This instrument has been tested and calibrated to meet the manufacturer's published specifications at an ISO-9001 certified facility. The standards used for the calibration are on record and traceable to the National Institute of Standards and Technology (NIST), and have accuracies equal to or greater than the instrument being tested. The calibration system complies with MIL-STD-45662A. Complete test records for each unit are maintained by Met One Instruments, Inc. and are available upon request. The BAM-1020 mass measurement subsystem does not require any periodic recalibration except in cases of factory repairs to the beta measurement subsystem or its components.

Met One Instruments Inc.
1600 NW Washington Blvd
Grants Pass OR 97526

www.metone.com
(541) 471-7111
(541) 471 7116 Fax

Calibration Certificate

Instrument	BX-596		
Job Number			
Customer			
Serial Number	N5400	Tested By	Lisa Quackenbush
Calibration Date	4/17/2012	Test Procedure	TP600226

MOI Q.C. Check Off ✓
- ☑ ID=3.50V ± 0.05VDC
- ☑ Temp AMB ± 2.25C
- ☑ Baro BP ±1.50mm Hg

This instrument has been calibrated against a Vaisala PTB220 factory working standard. The Vaisala PTB220 is traceable to the National Institute of Standards and Technology (NIST, USA) via Vaisala Measurement Standards Laboratory (MSL). Recommended calibration interval is 12 months from the first day of use.

Test Pressure hPa	Reference Pressure hPa	Observed Pressure hPa *	Observed Temperature Deg C	Correction hPa	Tolerence hPa	QA Pass/Fail
600	602.89	602.82	-50.70	0.07	+/- 0.35	◉ Pass ○ Fail
700	701.77	701.70	-50.70	0.07	+/- 0.35	◉ Pass ○ Fail
800	801.20	801.18	-50.70	0.02	+/- 0.35	◉ Pass ○ Fail
900	900.25	900.31	-50.70	-0.07	+/- 0.35	◉ Pass ○ Fail
1000	1000.03	1000.08	-50.70	-0.05	+/- 0.35	◉ Pass ○ Fail
1100	1097.19	1097.25	-50.70	-0.07	+/- 0.35	◉ Pass ○ Fail

* Data recorded using SDI-12 Interface. To obtain the true pressure, add the correction to the observed pressure reading.

Pressure Analog Test	Reference Pressure hPa **	Voltage Output	Observed Pressure hPa	Difference hPa **	Tolerence hPa	QA Pass/Fail
0-2.5 V	1020.0	2.002	1020.32	0.32	+/- 2.0	◉ Pass ○ Fail

Sensor Range is 700-1100 hPa

** Difference = Observed Pressure - Reference Pressure

Temperature Analog Test	Reference Temperature C	Voltage Output	Observed Temperature C	Difference Degrees C ***	Tolerance Degrees C	QA Pass/Fail
0-2.5 V	22.1	1.634	22.09	-0.01	+/- 1.0	◉ Pass ○ Fail

Sensor Range is -40 to +55 Degrees C = 0-2.5 Vdc out

*** Difference = Observed Temperature - Reference Temperature

Power Conditions

+V in: 12 +/- 1 Vdc Current: 10 +/- .5 mA

Type	Equip S/N	Calibration Due Date	Certificate Number
PTB220AAC1A1A1AB	C0220002	6/29/2012	T01155
Ertco 4400	304455	5/31/2012	N/A
Fluke 187	88790019	9/14/2012	N/A

Quality Assurance

05-15-2012
Date

This certificate will not be reproduced except in full.

CALIBRATION PROCEDURE & WORKSHEET FOR A MET ONE BAM-1020 PM_{10} MONITOR
(Using a BGI deltaCal)

Project: Bear Run Mine
Site: 2
Technician: Roy Roetman
Site Elevation: ~585'
Date/Time: 6/9/12 Start 1024 EST

	Make	Model	S/N
Sampler	Met One	BAM- 1020	N5275
Sampler Thermometer	Met One	BX-596	N5411
Cal Thermometer	BGI	deltaCal	490
Cal Barometer	BGI	deltaCal	490
Cal Flow Device	BGI	deltaCal	490

I. **Leak check:** Make sure pump is off. Remove the inlet head and connect the leak check device (part no. BX-302 or equivalent). From the main menu, go to "TEST" then "TAPE" screen, advance the tape one window. From the main menu go to "TEST" then "PUMP" screen, turn on the pump. Make sure device is set to closed position. After a few seconds, look to see that the flow is below 1.0 LPM. Turn pump off. Remove leak check device.
PASS / FAIL circle one Flow: 0.1 LPM (should be less than 1.0 LPM)

II. **Self test:** From the main menu, go to "TAPE" then "SELF TEST". PASS / FAIL circle one

III. **As Found Calibration:** Connect the NIST-traceable reference flow measurement device. From the main menu, go to "TEST" then "FLOW" screen. Record the temperature and pressure readings in the "As Found" table. Using the "NEXT" hot key, scroll through the Ambient Temperature "AT" field and Barometric Pressure "BP" field. When you get the cursor to the "FLOW 1" field, the pump will start. Let the pump run for five minutes at the point, then record your readings. Repeat this procedure for all three flows.

As Found

	BAM	REFERENCE	% Diff	Difference
Ambient Temperature (AT °C)	See T calibration doc.			—
Barometric Pressure (BP mmHg)	See BP calibration document			—
Flow 1 Reading (15.0 LPM)	15.0	15.00	0.0	
Flow 2 Reading (18.4 LPM)	18.4	18.37	+ 0.2	
Flow 3 Reading (16.7 LPM)	16.7	16.70	0.0	

The temperature readings for the BAM and calibration thermometer should agree to within ± 2°C. The barometric pressure readings should agree to within ± 10mmHg. The manufacturer's Operation Manual calibration procedure desires that the sampler and reference flow rates should agree to ±1%. If the readings are outside of these limits, proceed to the "As Left" Calibration in Step IV.

IV. **As Left Calibration:** Following the procedure in Step III, enter the flow calibration screen. Calibrate your temperature and/or pressure if necessary. If you do not need to adjust a parameter, press the "NEXT" hot key to scroll through, and notate "NA" in the appropriate boxes. To calibrate the temperature/pressure, adjust the "STD" field to your reference device reading using the red arrow keys. Hit the "CAL" hot key, both the "BAM" and "STD" reading should now read the same. Record your adjusted values in the "As Left" table.

Hit the "NEXT" hot key to scroll to "FLOW 1", let equilibrate for five minutes; calibrate as necessary. To calibrate, set the "STD" field to your reference device reading and hit the "CAL" hot key. Record your readings in the "As Left" table. Follow this procedure to calibrate the remaining flows as necessary. The "CAL" hot key will only adjust "FLOW 3", and only after you have entered the "STD" for "FLOW 1" and "FLOW 2". This is a three point calibration; all points must be accurate to properly adjust the flow of the BAM.

As Left

	BAM	REFERENCE	% Diff	Difference
Ambient Temperature (AT °C)				
Barometric Pressure (BP mmHg)				
Flow 1 Reading (15.0 LPM)				
Flow 2 Reading (18.4 LPM)				
Flow 3 Reading (16.7 LPM)				

Hit "EXIT" to return to Main Menu. Leave unit in Main Menu reading "Status: ON"

Record End Time 1130 EST

Comments: Set up for Zero Background Check
Test to begin at 1200 EST
Factory background (BKGD) setting is -0.0037
BKGD Set to 0.000 for 72 hr test. 0900 +3.2 (RR) = +0.0032
Test ran 6/9/12 1300 EST → 6/13/12 ~~1000~~ (RR) EST Avg Conc = ~~+1.9~~ µg/m³ = ~~0.0014~~ mg/m³ RR
New BKGD constant is ~~-0.0019 mg/m³~~ (RR) = -0.0032
Conc set to ACTUAL
TYPE
Data Collection to Start 6/13/12 @ 1300 EST/RR

Site 2

Date 6/9/12

TEMPERATURE CALIBRATION FORM

Project Bear Run Mine Site 2
Date/Time 6/9/12 Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Sensor	Met One	BX596	N5411
Data Acquisition	Met One	BAM1020	N5275
Ref. Thermometer	Cooper	TC100A	C06396

System Inspection: Cable New Sensor New Radiation Shield/~~Motor~~ New (Pass/Fail)
List Weather Conditions (wind, sky cover) Lt breeze, partly cloudy, warm
Sensor Height ~1.7m AGL

Calibration Point: Ice H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1043	RR ~~21~~ +0.4	0.0	
2	1044	+0.3	0.0	
3	1045	+0.3	0.0	
4	1046	+0.2	0.0	
5	1047	+0.2	0.0	Difference
Average		+0.3	0.0	+0.3 (°C)

Calibration Point: Warm H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1035	21.3	21.2	
2	1036	RR ~~12~~ 21.3	21.2	
3	1037	21.2	21.2	
4	1038	21.3	21.2	
5	1039	21.2	21.3	Difference
Average		21.3	21.2	+0.1 (°C)

Calibration Point: Hot Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1050	43.2	43.4	
2	1051	43.3	43.3	
3	1052	43.3	43.3	
4	1053	43.2	43.1	
5	1054	43.2	43.1	Difference
Average		43.2	43.2	0.0 (°C)

If needed, perform cleaning and maintenance. Describe any work performed
COMMENTS:

' 22 6/15/12

BAROMETRIC PRESSURE CALIBRATION FORM

Project Bear Run Mine
Date 6/9/12

Site 2
Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Site Sensor	Met One	BX 596	N 5411
Data Acquis.	Met One	BAM 1020	N5275
Field Barometer	BGI	delta Cal	490

Field Barometer Certification Date: 3/2/12

Location of Sensor: On BAM Mast

I. System Inspection: Cable New Sensor New

II. Pre-adjustment System Check

TIME (EST)	Data Logger Reading (mm Hg)	Field Cal. Device		Difference (mm Hg)
		Reading (mm Hg)	Reading ( )	
1024	746	746.5		-0.5
1044	745	747.0		-2.0
1107	745	746.5		-1.5

III. Maintenance and Adjustments

1) If needed, complete maintenance, repairs and/or adjustments as per manufacturer's operation manual.
2) Describe any maintenance, repairs or adjustments in the Comments Section of the form.

IV. Post-adjustment System Check (if necessary)

TIME ( )	Data Logger Reading (of Hg)	Field Cal. Device		Difference ( )
		Reading ( )	Reading ( )	
		N/A		

Comments:

Met One Instruments, Inc.
1600 Washington Blvd. Grants Pass, OR 97526 (541) 471-7111 www.metone.com

Certificate of Calibration

Model BAM 1020

Beta Attenuation Mass Monitor

BAM 1020 Serial Number: N5275 **Sales Order:**

Calibration Performed By: Tasey Graves **Calibration Date:** 4/18/2012

Final Quality Inspection by: J Dengem **Inspection Date:** 5-22-12

Configuration: ☐ PM 10 FEM ☒ PM 2.5 FEM ☐ PM 10-2.5 Coarse FEM ☐ PM 10 EU ☐ PM 2.5 EU

Condition: ☒ New Unit ☐ Demonstration Unit ☐ Repair/Upgrade/Recalibration

The BAM 1020 is designated as a U.S. EPA Federal Equivalent Method (FEM) for PM_{10} and $PM_{2.5}$ continuous particulate monitoring in accordance with 40 CFR Part 53, when equipped with appropriate settings and accessories. Older revision units must be upgraded to the latest specs in order to be $PM_{2.5}$ compatible. See the manual for details.

PM_{10} **EQPM-0798-122** $PM_{2.5}$ **EQPM-0308-170** $PM_{10-2.5}$ **EQPM-0709-185**

Factory Calibration Settings		
Name	**Setting**	**Description**
K	*0.971*	Concentration Slope Multiplier
BKGD	*-0.0037*	Concentration Offset, mg/m^3
ABS	*0.801*	Span Membrane Mass mg/cm^2
µsw	*0.302*	Absorption Coefficient
C_V	*1.037*	Flow Sensor Coefficient of Variability
Q_O	*0.000*	Flow Sensor Zero Correction SLPM

These settings are unit-specific calibration values which have been determined during dynamic testing, and should never be changed without specific instructions from Met One Instruments. See the operation manual. The BKGD background correction value may be field audited and altered.

Other Unit Parameters	
BAM 1020 Firmware:	*3236-5 v3.6.8*
Report Processor Firmware:	*80353-03 V2.1.1*
Panel PC Software:	*N/A*
Beta Source Serial Number:	*TV 463*
Beta Detector Voltage VDC:	*-875*
AC Power Supply Setting:	*120/60*

Concentration Stability Results	
Hourly Sensitivity (σ)	*0.0016*
Hourly Detection Limit (2σ)	*3.2*
24 Hour Detection Limit (2σ/5)	*0.64*

Test and Calibration Standards			
Standards	*Model*	*SN*	*Cal Due*
Flow Meter	*DC-HC-1*	*Cell 2251, Base 3432*	*10/7/2012*
MULTIMETER	*189 Multimeter*	*82310054*	*6/8/2012*
BAM	*083D-1-6*	*X6315*	*5/25/2012*
Baro Pressure	*BP 091 (26/32-1)*	*B5817*	*5/2/2013*
BAM-1020 FEM2.5	*BAM-1020 FEM2.5*	*N2402*	*2/10/2013*

This instrument has been tested and calibrated to meet the manufacturer's published specifications at an ISO-9001 certified facility. The standards used for the calibration are on record and traceable to the National Institute of Standards and Technology (NIST), and have accuracies equal to or greater than the instrument being tested. The calibration system complies with MIL-STD-45662A. Complete test records for each unit are maintained by Met One Instruments, Inc. and are available upon request. The BAM-1020 mass measurement subsystem does not require any periodic recalibration except in cases of factory repairs to the beta measurement subsystem or its components.

Met One Instruments Inc.
1600 NW Washington Blvd
Grants Pass OR 97526

www.metone.com
(541) 471-7111
(541) 471 7116 Fax

Calibration Certificate

Instrument	BX-596		
Job Number			
Customer			
Serial Number	N5411	Tested By	Lisa Quackenbush
Calibration Date	4/17/2012	Test Procedure	TP600226

MOI Q.C. Check Off

- [x] ID=3.50V ± 0.05VDC
- [x] Temp AMB ± 2.25C
- [x] Baro BP ±1.50mm Hg

This instrument has been calibrated against a Vaisala PTB220 factory working standard. The Vaisala PTB220 is traceable to the National Institute of Standards and Technology (NIST, USA) via Vaisala Measurement Standards Laboratory (MSL). Recommended calibration interval is 12 months from the first day of use.

Test Pressure hPa	Reference Pressure hPa	Observed Pressure hPa *	Observed Temperature Deg C	Correction hPa	Tolerence hPa	QA Pass/Fail
600	602.09	601.97	-50.60	0.12	+/- 0.35	◉ Pass ○ Fail
700	701.84	701.69	-50.60	0.15	+/- 0.35	◉ Pass ○ Fail
800	800.48	800.41	-50.60	0.08	+/- 0.35	◉ Pass ○ Fail
900	900.23	900.38	-50.60	-0.15	+/- 0.35	◉ Pass ○ Fail
1000	1000.03	1000.11	-50.60	-0.08	+/- 0.35	◉ Pass ○ Fail
1100	1097.79	1097.85	-50.60	-0.07	+/- 0.35	◉ Pass ○ Fail

* Data recorded using SDI-12 Interface. To obtain the true pressure, add the correction to the observed pressure reading.

Pressure Analog Test	Reference Pressure hPa **	Voltage Output	Observed Pressure hPa	Difference hPa **	Tolerence hPa	QA Pass/Fail
0-2.5 V	1021.1	2.010	1021.6	0.50	+/- 2.0	◉ Pass ○ Fail

Sensor Range is 700-1100 hPa

** Difference = Observed Pressure - Reference Pressure

Temperature Analog Test	Reference Temperature C	Voltage Output	Observed Temperature C	Difference Degrees C ***	Tolerance Degrees C	QA Pass/Fail
0-2.5 V	21.7	1.627	21.83	0.13	+/- 1.0	◉ Pass ○ Fail

Sensor Range is -40 to +55 Degrees C = 0-2.5 Vdc out

*** Difference = Observed Temperature - Reference Temperature

Power Conditions
+V in: 12 +/- 1 Vdc Current: 10 +/- .5 mA

Type	Equip S/N	Calibration Due Date	Certificate Number
PTB220AAC1A1A1AB	C0220002	6/29/2012	T01155
Ertco 4400	304455	5/31/2012	N/A
Fluke 187	88790019	9/14/2012	N/A

Quality Assurance

05-15-2012
Date

F75107 Rev C

This certificate will not be reproduced except in full.

✓ 6/15/12

CALIBRATION PROCEDURE & WORKSHEET FOR A MET ONE BAM-1020 PM_{10} MONITOR
(Using a BGI deltaCal)

Project: Bear Run Mine
Technician: Ray Roetman
Date/Time: 6/9/12 1212 EST - Start

Site: 3
Site Elevation: ~ 585'

	Make	Model	S/N
Sampler	Met One	BAM- 1020	N 5507
Sampler Thermometer	Met One	BX 596	N 5405
Cal Thermometer	BGI	deltaCal	490
Cal Barometer	BGI	deltaCal	490
Cal Flow Device	BGI	deltaCal	490

I. **Leak check:** Make sure pump is off. Remove the inlet head and connect the leak check device (part no. BX-302 or equivalent). From the main menu, go to "TEST" then "TAPE" screen, advance the tape one window. From the main menu go to "TEST" then "PUMP" screen, turn on the pump. Make sure device is set to closed position. After a few seconds, look to see that the flow is below 1.0 LPM. Turn pump off. Remove leak check device.
PASS / FAIL circle one Flow: 0.2 LPM (should be less than 1.0 LPM)

II. **Self test:** From the main menu, go to "TAPE" then "SELF TEST". PASS / FAIL circle one

III. **As Found Calibration:** Connect the NIST-traceable reference flow measurement device. From the main menu, go to "TEST" then "FLOW" screen. Record the temperature and pressure readings in the "As Found" table. Using the "NEXT" hot key, scroll through the Ambient Temperature "AT" field and Barometric Pressure "BP" field. When you get the cursor to the "FLOW 1" field, the pump will start. Let the pump run for five minutes at the point, then record your readings. Repeat this procedure for all three flows.

As Found

	BAM	REFERENCE	% Diff	Difference
Ambient Temperature (AT °C)	See T calibration form			—
Barometric Pressure (BP mmHg)	See BP calibration form			—
Flow 1 Reading (15.0 LPM)	15.0	14.96	+0.3	
Flow 2 Reading (18.4 LPM)	18.4	18.46	-0.3	
Flow 3 Reading (16.7 LPM)	16.7	16.65	+0.3	

The temperature readings for the BAM and calibration thermometer should agree to within ± 2°C. The barometric pressure readings should agree to within ± 10mmHg. The manufacturer's Operation Manual calibration procedure desires that the sampler and reference flow rates should agree to ±1%. If the readings are outside of these limits, proceed to the "As Left" Calibration in Step IV.

IV. **As Left Calibration:** Following the procedure in Step III, enter the flow calibration screen. Calibrate your temperature and/or pressure if necessary. If you do not need to adjust a parameter, press the "NEXT" hot key to scroll through, and notate "NA" in the appropriate boxes. To calibrate the temperature/pressure, adjust the "STD" field to your reference device reading using the red arrow keys. Hit the "CAL" hot key, both the "BAM" and "STD" reading should now read the same. Record your adjusted values in the "As Left" table.

Hit the "NEXT" hot key to scroll to "FLOW 1", let equilibrate for five minutes; calibrate as necessary. To calibrate, set the "STD" field to your reference device reading and hit the "CAL" hot key. Record your readings in the "As Left" table. Follow this procedure to calibrate the remaining flows as necessary. The "CAL" hot key will only adjust "FLOW 3", and only after you have entered the "STD" for "FLOW 1" and "FLOW 2". This is a three point calibration; all points must be accurate to properly adjust the flow of the BAM.

As Left

	BAM	REFERENCE	% Diff	Difference
Ambient Temperature (AT °C)				
Barometric Pressure (BP mmHg)				
Flow 1 Reading (15.0 LPM)				
Flow 2 Reading (18.4 LPM)				
Flow 3 Reading (16.7 LPM)				

Hit "EXIT" to return to Main Menu. Leave unit in Main Menu reading "Status: ON"

Record End Time 1320 EST

Comments: Set up for Zero Background Test – to begin @ 1400 EST
Factory background (BKGD) is -0.0008
Set BKGD to 0.0000 for 72hr test
BKGD test run from 6/9/12 1500 EST to 6/13/12 0800 EST
Avg Conc measured = -0.5 µg/m³ = -0.0005 mg/m³
New BKGD constant = ~~+0.5~~ +0.0005 mg/m³
Set CONC TYPE to ACTUAL
Data Collection to commence @ 1400 EST

Site 3

Date 6/9/12

vay 22 6/15/12

Form No. 2095D.1
Revision No. 2
Date 5/12
Page 1 of 1

BAROMETRIC PRESSURE CALIBRATION FORM

Project Bear Run Mine
Date 6/9/12

Site 3
Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Site Sensor	Met One	BX 596	N5405
Data Acquis.	Met One	BAM 1020	N5507
Field Barometer	BGI	delta Cal	490

Field Barometer Certification Date: 3/2/12

Location of Sensor: ~~On~~ On mast of BAM

I. System Inspection: Cable New Sensor New

II. Pre-adjustment System Check

TIME (EST)	Data Logger Reading (mm/dg)	Field Cal. Device Reading (mm Hg)	Field Cal. Device Reading ( )	Difference (mm Hg)
1223	747	746		+1.0
1249	747	745.5		+1.5
1311	747	745.5		~~+1.5~~ +1.5

III. Maintenance and Adjustments

1) If needed, complete maintenance, repairs and/or adjustments as per manufacturer's operation manual.
2) Describe any maintenance, repairs or adjustments in the Comments Section of the form.

IV. Post-adjustment System Check (if necessary)

TIME ( )	Data Logger Reading (of Hg)	Field Cal. Device Reading ( )	Field Cal. Device Reading ( )	Difference ( )
		N/A		

Comments:

TEMPERATURE CALIBRATION FORM

Project Bear Run Mine Site 3
Date/Time 6/9/12 Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Sensor	Met One	RR ~~BO~~ BX596	N5405
Data Acquisition	Met One	BAM 1020	N5507
Ref. Thermometer	Cooper	TC100A	C306396

System Inspection: Cable New Sensor New Radiation Shield/~~Motor~~ New (Pass/Fail)
List Weather Conditions (wind, sky cover) A few clouds, hot, lt breeze
Sensor Height ~1.7m AGL - on BAM mast

Calibration Point: Ice H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1244	+0.2	0.0	
2	1245	+0.1	0.0	
3	1246	+0.1	0.0	
4	1247	+0.1	0.0	
5	1248	+0.1	0.0	Difference
Average		+0.1	0.0	+0.1 (°C)

Calibration Point: Warm H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1237	22.1	22.2	
2	1238	22.0	22.2	
3	1239	22.1	22.2	
4	1240	22.1	22.2	
5	1241	22.0	22.2	Difference
Average		22.1	22.2	-0.1 (°C)

Calibration Point: Hot Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1252	41.1	41.3	
2	1253	41.1	41.3	
3	1254	41.2	41.3	
4	1255	41.2	41.2	
5	1256	41.1	41.2	Difference
Average		41.1	41.3	-0.2 (°C)

If needed, perform cleaning and maintenance. Describe any work performed
COMMENTS:

Met One Instruments, Inc.
1600 Washington Blvd. Grants Pass, OR 97526 (541) 471-7111 www.metone.com

Certificate of Calibration

Model BAM 1020

Beta Attenuation Mass Monitor

BAM 1020 Serial Number: N5507 **Sales Order:**

Calibration Performed By: Tasey Graves **Calibration Date:** 4/27/2012

Final Quality Inspection by: J. Hengen **Inspection Date:** 5-22-12

Configuration: ☐ PM 10 FEM ☒ PM 2.5 FEM ☐ PM 10-2.5 Coarse FEM ☐ PM 10 EU ☐ PM 2.5 EU

Condition: ☒ New Unit ☐ Demonstration Unit ☐ Repair/Upgrade/Recalibration

The BAM 1020 is designated as a U.S. EPA Federal Equivalent Method (FEM) for PM_{10} and $PM_{2.5}$ continuous particulate monitoring in accordance with 40 CFR Part 53, when equipped with appropriate settings and accessories. Older revision units must be upgraded to the latest specs in order to be $PM_{2.5}$ compatible. See the manual for details.

PM_{10} **EQPM-0798-122** $PM_{2.5}$ **EQPM-0308-170** $PM_{10-2.5}$ **EQPM-0709-185**

Factory Calibration Settings		
Name	**Setting**	**Description**
K	*0.966*	Concentration Slope Multiplier
BKGD	*-0.0008*	Concentration Offset, mg/m^3
ABS	*0.834*	Span Membrane Mass mg/cm^2
μsw	*0.302*	Absorption Coefficient
C_V	*1.040*	Flow Sensor Coefficient of Variability
Q_O	*0.000*	Flow Sensor Zero Correction SLPM

These settings are unit-specific calibration values which have been determined during dynamic testing, and should never be changed without specific instructions from Met One Instruments. See the operation manual. The BKGD background correction value may be field audited and altered.

Other Unit Parameters	
BAM 1020 Firmware:	*3236-5 v3.6.8*
Report Processor Firmware:	*80353-03 V2.1.1*
Panel PC Software:	*N/A*
Beta Source Serial Number:	*TV499*
Beta Detector Voltage VDC:	*-925*
AC Power Supply Setting:	*120/60*
Concentration Stability Results	
Hourly Sensitivity (σ)	*0.0016*
Hourly Detection Limit (2σ)	*3.2*
24 Hour Detection Limit (2σ/5)	*0.64*

Test and Calibration Standards			
Standards	*Model*	*SN*	*Cal Due*
Flow Meter	*DC-HC-1*	*Cell 2251, Base 3432*	*10/7/2012*
MULTIMETER	*189 Multimeter*	*82310054*	*6/8/2012*
BAM	*083D-1-6*	*X6315*	*5/25/2012*
Baro Pressure	*BP 091 (26/32-1)*	*B5817*	*5/2/2013*
BAM-1020 FEM2.5	*BAM-1020 FEM2.5*	*N2402*	*2/10/2013*

This instrument has been tested and calibrated to meet the manufacturer's published specifications at an ISO-9001 certified facility. The standards used for the calibration are on record and traceable to the National Institute of Standards and Technology (NIST), and have accuracies equal to or greater than the instrument being tested. The calibration system complies with MIL-STD-45662A. Complete test records for each unit are maintained by Met One Instruments, Inc. and are available upon request. The BAM-1020 mass measurement subsystem does not require any periodic recalibration except in cases of factory repairs to the beta measurement subsystem or its components.

Met One Instruments Inc.
1600 NW Washington Blvd
Grants Pass OR 97526

www.metone.com
(541) 471-7111
(541) 471 7116 Fax

Calibration Certificate

Instrument BX-596
Job Number
Customer
Serial Number N5405 Tested By Lisa Quackenbush
Calibration Date 4/17/2012 Test Procedure TP600226

MOI Q.C. Check Off
- [x] ID=3.50V ± 0.05VDC
- [x] Temp AMB ± 2.25C
- [x] Baro BP ±1.50mm Hg

This instrument has been calibrated against a Vaisala PTB220 factory working standard. The Vaisala PTB220 is traceable to the National Institute of Standards and Technology (NIST, USA) via Vaisala Measurement Standards Laboratory (MSL). Recommended calibration interval is 12 months from the first day of use.

Test Pressure hPa	Reference Pressure hPa	Observed Pressure hPa *	Observed Temperature Deg C	Correction hPa	Tolerence hPa	QA Pass/Fail
600	602.09	601.98	-50.60	0.11	+/- 0.35	◉ Pass ○ Fail
700	701.84	701.68	-50.60	0.15	+/- 0.35	◉ Pass ○ Fail
800	800.48	800.40	-50.60	0.08	+/- 0.35	◉ Pass ○ Fail
900	900.23	900.38	-50.60	-0.15	+/- 0.35	◉ Pass ○ Fail
1000	1000.03	1000.12	-50.60	-0.09	+/- 0.35	◉ Pass ○ Fail
1100	1097.79	1097.86	-50.60	-0.08	+/- 0.35	◉ Pass ○ Fail

* Data recorded using SDI-12 Interface. To obtain the true pressure, add the correction to the observed pressure reading.

Pressure Analog Test	Reference Pressure hPa **	Voltage Output	Observed Pressure hPa	Difference hPa **	Tolerence hPa	QA Pass/Fail
0-2.5 V	1020.8	2.008	1021.28	0.48	+/- 2.0	◉ Pass ○ Fail

Sensor Range is 700-1100 hPa

** Difference = Observed Pressure - Reference Pressure

Temperature Analog Test	Reference Temperature C	Voltage Output	Observed Temperature C	Difference Degrees C ***	Tolerance Degrees C	QA Pass/Fail
0-2.5 V	22.0	1.633	22.05	0.05	+/- 1.0	◉ Pass ○ Fail

Sensor Range is -40 to +55 Degrees C = 0-2.5 Vdc out

*** Difference = Observed Temperature - Reference Temperature

Power Conditions

+V in: 12 +/- 1 Vdc Current: 10 +/- .5 mA

Type	Equip S/N	Calibration Due Date	Certificate Number
PTB220AAC1A1A1AB	C0220002	6/29/2012	T01155
Ertco 4400	304455	5/31/2012	N/A
Fluke 187	88790019	9/14/2012	N/A

Quality Assurance

05-15-2012
Date

This certificate will not be reproduced except in full.

Appendix C
Certificates of Calibration - PM_{10} Flow Rate Calibration Devices

TISCH ENVIROMENTAL, INC.
145 SOUTH MIAMI AVE.
VILLAGE OF CLEVES, OH 45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX
WWW.TISCH-ENV.COM

AIR POLLUTION MONITORING EQUIPMENT

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Jan 11, 2012 Rootsmeter S/N 0438320 Ta (K) - 294
Operator Tisch Orifice I.D. - 148N Pa (mm) - 750.57

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.2860	4.1	1.50
2	NA	NA	1.00	0.9930	6.9	2.50
3	NA	NA	1.00	0.9060	8.2	3.00
4	NA	NA	1.00	0.8390	9.6	3.50
5	NA	NA	1.00	0.6310	16.5	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9955	0.7741	1.2254		0.9945	0.7733	0.7665
0.9918	0.9988	1.5820		0.9907	0.9977	0.9896
0.9900	1.0927	1.7329		0.9890	1.0916	1.0840
0.9882	1.1778	1.8718		0.9871	1.1766	1.1709
0.9789	1.5514	2.4507		0.9779	1.5498	1.5330

Qstd slope (m) = 1.57687
intercept (b) = 0.00803
coefficient (r) = 0.99991

Qa slope (m) = 0.98741
intercept (b) = 0.00502
coefficient (r) = 0.99991

y axis = SQRT[H2O(Pa/760)(298/Ta)]

y axis = SQRT[H2O(Ta/Pa)]

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}

Certificate of Calibration

Tech Instrumentation

160 West Kiowa Avenue
Elizabeth, CO 80107
(303) 841-7567

Laboratory Test Number
45324

Date of Calibration
5/10/2012

Date Due
5/10/2013

Tested for: McVehil-Monnett Associates, Inc - Englewood, CD

PO Number: 900-Met-582

Instrument Under Test			
Manufacturer: Cooper Instruments		Mfgr. Spec'd Accuracy:	±0.3°F
Model: TC1paA		As Received, this meter meets specifications (Y/N)	Y
Serial Number: c306956		After Calibration, This meter meets specifications (Y/N)	Y

Test Results - Thermometer Only - Resistive input to simulate an ideal probe

Simulated Temperature	Calibration as Received		After Calibration*	
-31.0°F / -35.0°C	-31.0	-35.0		
-22.0°F / -30.0°C	-22.1	-30.1		
5.0°F / -15.0°C	5.0	-15.0		
34.0°F / 1.1°C	34.0	1.1		
77.0°F / 25.0°C	77.0	25.0		
98.6°F / 37.0°C	98.6	37.0		
113.0°F / 45.0°C	113.0	45.0		
212.0°F / 100.0°C	212.1	100.1		
293.0°F / 145.0°C	292.0	144.4		

*Note: If no "After Calibration"data is provided, no adjustments were made to the calibration of the meter. The calibration was left "As Received".

SYSTEM CALIBRATION RESULTS -

The data below represents your system calibration -- Your thermometer with probe(s). Please note that since this is a system calibration, this certification is valid only with the specific probes tested. If you have multiple meters and/or probes, you must use care not to switch them. The accuracy of our system is at least 4 times better than the specified accuracy of your instrument, unless noted below. Our systems uncertainty used for this calibration is 0.037°F.

The standard used to verify the calibration of your system is a: Ertco-Eutechnics, Model 4400, S/N: 3030e2

Calibrated on 4/20/2012 Recall date 04/20/2013

Tech Instrumentation, Inc. certifies that your system meets or exceeds all published specifications unless otherwise noted in the comments section below. The calibration data below was obtained using measurement standards that are traceable to the National Institute of Standards and Technology (NIST) or natural physical constants, by immersing the probe in a constant temperature bath with our standard which determined the actual test temperature. The results stated on this report relate only to the items specifically identified. This report may not be reproduced except in full, without approval of Tech Instrumentation, Inc.

Test Procedure Used: TM99A Uncertainty Estimate: 0.037°F

Acceptance Criteria: Manufacturer's Specifications

Probe Model	1075	
Probe S/N	c306956	
	Degrees F	Degrees C
Bath Temp		-19.97
Probe Temp		-20.0
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Probe Model	1075	
Probe S/N	c306956	
	Degrees F	Degrees C
Bath Temp		10.00
Probe Temp		10.0
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Probe Model	1075	
Probe S/N	c306956	
	Degrees F	Degrees C
Bath Temp		39.99
Probe Temp		39.9
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Authorized Signature: Horst Rossmueller II

Ambient Temperature: 71.5°F

Ambient RH: 29%

Comments:

BGI INCORPORATED 58 GUINAN STREET WALTHAM, MA 02451
NIST Traceable Calibration Facility, Registered ISO 9001:2008

deltaCal

CERTIFICATE OF CALIBRATION - NIST TRACEBILITY

(Refer to instruction manual for further details of calibration)

deltaCal Serial Number: 000490 DATE 2-MAR-2012

Calibration Operator: Brian DeVoe

Critical Venturi Flow Meter: Max Uncertainty = 0.346%
Serial Number: 1A *CEESI NVLAP NIST Data File 07BGI-0001*
Serial Number: 2A *CEESI NVLAP NIST Data File 07BGI-0003*
Serial Number: 4A *CEESI NVLAP NIST Data File 07BGI-0002*

Room Temperature : Uncertainty = 0.071% Room Temperature: 22.7 C
Brand: *Brooklyn Thermometer* Serial Number: 9418
NIST Traceability No. 516837
deltaCal:
Ambient Temperature (set): 22.7 C
Aux (filter) Temperature (set): 22.7 C

Barometric Pressure and Absolute Pressure
Vaisala Model PTB331 Accuracy: 0.03176%
S/N D1430002
NIST Traceable Princo Cert. No. P-7485
deltaCal:
Barometric Pressure (set): **763** mm of Hg

Results of Venturi Calibration

Flow Rate (Q) vs. Pressure Drop (ΔP). Where: Q=Lpm, ΔP= Cm of H_2O

Q= 3.81336 ΔP ^ 0.51379

Overall Uncertainty: 0.35%

Date Placed In Service_____
(To be filled in by operator upon receipt)

Recommended Recalibration Date _____
(12 months from date placed in service)

Revised: July 2007

To Check a deltaCal 2-Mar-12 BD

2-20 Lpm VER 2.56X

BP= 763 mm of Hg

Maximum allowable error at any flow rate is .75%. T= 22.7 C

Serial No. **490**

	Reading Abs. P Crit. Vent. mm of Hg	Crit. Vent. Temp	Q 760/20 Flow Lpm	QA Flow Lpm	QA deltaCal Indicated	% Error
# 2	220.72	21.6	2.44	2.45	2.46	**0.37**
	494.43	21.6	5.52	5.55	5.53	**-0.33**
# 1	253.38	21.6	9.81	9.86	9.84	**-0.20**
	426.01	21.6	16.62	16.71	16.70	**-0.07**
	489.19	21.6	19.12	19.22	19.26	**0.21**
					Average %	**0.00**

Appendix D
Performance Audit Report: June 19, 2012

for **Peabody Midwest Mining LLC**
Bear Run Mine
Carlisle, Indiana

Startup June 2012 Performance Audit Air Quality Monitoring Instrumentation For the Bear Run Mine

July 2012
MMA Project Number 2507-11

by McVehil-Monnett Associates, Inc.

44 Inverness Drive East, Building C
Englewood, CO 80112
(303) 790-1332

1.0 INTRODUCTION

McVehil-Monnett Associates completed the meteorological and particulate sampling performance audit for Peabody Midwest Mining LLC at the Bear Run Mine located northeast of Carlisle, Indiana on June 19, 2012. This report summarizes the results of the performance audit that was conducted in accordance with the following guidance documents:

- "Quality Assurance Handbook for Air Pollution Measurement Systems", Vol. II– Part II, Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere (High Volume PM_{10} Sampler Method), U.S. Environmental Protection Agency, September 1997

- "Meteorological Monitoring Guidance for Regulatory Modeling Applications", (EPA-454/R-99-005), February 2000.

The remainder of this report is divided into sections on specific auditing procedures (Section 2.0), audit results (Section 3.0), and conclusions (Section 4.0). Attachment A contains the audit documents and Attachment B contains the audit instruments' calibration certificates and documentation.

2.0 AUDITING PROCEDURES

The meteorological parameters audited at the site meteorological tower were horizontal wind speed and wind direction at 10 meters, temperature at 2 meters, precipitation and barometric pressure.

Wind direction was audited for linearity and vane orientation. The linearity of the sensor was tested using a linearity wheel to set the vane at 10 different directions and checking the system response. The vane orientation was checked by sighting the vane to the tower vertical member in both directions and comparing the system output to the known azimuth of these vane positions. In addition, a landmark position was used to check orientation. Vane bearing torque was measured using a vane torque gauge manufactured by the wind sensor's manufacturer.

Horizontal wind speed was audited using a selectable speed anemometer drive, which turns the sensor anemometer shaft at five rates of rotation. The values recorded by the wind speed measurement system were then compared to the target wind speeds for these rates of rotation. The starting torque of the wind speed sensor was measured using a torque watch gauge.

Temperature was audited by comparing the system output to a calibrated digital thermometer at three different temperatures (an ice water bath, a warm water bath, and a hot water bath).

Barometric pressure was audited using an audit barometer and comparing the readings to the site sensor or sampler pressure sensor.

The tipping bucket precipitation gauge was audited by adding a precise volume of water to the gauge from a Class A measuring pipette. The average amount of water needed to tip the precipitation gauge bucket one time was calculated from the amount of water input divided by the number of bucket tips. This average value was compared to the manufacturer's listed value for volume per tip.

The continuous PM_{10} samplers (low flow) were audited with a certified volumetric flow device called a delta calibrator (deltaCal). The deltaCal gives a direct indication of the flow rate of the sampler, which was then compared to the flow rate displayed by the microprocessor of the controlled sampler. The deltaCal is an EPA-FRM compatible field audit device. The deltaCal measures the volumetric flow rate by utilizing a pressure transducer to assess the pressure drop caused by the air being drawn through a venturi.

The inhalable particulate (PM_{10}) sampler (high flow) was audited using a calibrated critical orifice. The audit flow rate determined from the orifice calibration curve was compared to the sampler flow rate that was calculated using data from the most recent calibration curve for the sampler. The actual flow rate of the PM_{10} sampler was also compared to its design flow rate of 1.13 actual cubic meters per minute (acmm).

3.0 AUDIT RESULTS

Three sites were audited for Bear Run Mine, Site 1, 2, and 3. Site 1 has a continuous Met One BAM 1020 PM_{10} (low volume) sampler and a Tisch Environmental (high volume) PM_{10} sampler. Site 2 has a BAM 1020 sampler and Site 3 has a BAM 1020 and the meteorological instrumentation.

Site 1

Site 1 has two different types of PM_{10} samplers; one Met One BAM 1020 (continuous) and one Tisch Environmental high flow sampler.

All the audit results were acceptable for the BAM 1020 sampler and are detailed in Table 1. Copies of the forms are contained in Appendix A. The audit measured flows of 14.81, 16.55 and 18.33 lpm at the sampler reported rates of 15.0, 16.7 and 18.4, respectively. The percent differences of these flows are 1.3, 0.9 and 0.4, respectively. The audit acceptance is ±4.0 percent. The leak check and self test passed.

The temperature and pressure sensors used by the BAM sampler were also audited and passed the audit specifications. The results of the temperature and pressure audit are detailed in Table 1.

The audit flow rate, which is determined from the orifice calibration curve, was compared to the sampler flow rate from the most recent calibration curve for the sampler. The Tisch PM_{10} sampler flow rate of 1.117 actual m^3/min (acmm) was 0.8% lower than the audit flow rate of 1.126 acmm. The result was within the ±7 percent acceptance limit.

The actual flow rate of the PM_{10} sampler was also compared to the design flow rate of 1.13 accm. The audit determined the actual flow rate to be 1.143 acmm or 1.2% higher than the design rate. The result was within the ±10 percent audit acceptance limit.

The temperature and pressure sensors on the Tisch sampler were also audit and found to be within audit specifications. The results are detailed in Table 1.

Site 2

All the audit results were acceptable for the sampler and are detailed in Table 2. Copies of the audit forms are presented in Appendix A. The audit measured the flows of 15.02, 16.67 and 18.43 lpm for the sampler reported rates of 15.0, 16.7 and 18.4 lpm, respectively. The percent differences of these flows are -0.1, 0.2 and -0.2, respectively. The audit acceptance is ±4.0 percent. A leak check and self test were completed and all results were passing.

The temperature and pressure sensors used by the BAM sampler were also audited. The results of the temperature and pressure audit were within audit specifications and are detailed in Table 2.

Site 3
Meteorological

Results for the meteorological audit are presented in Table 3. Copies of the audit forms for the meteorological sensors are contained in Attachment A. A brief discussion of the results follows.

At the Bear Run Creek meteorological station, the wind direction audit results indicated that the system response was linear and the vane was correctly oriented. The data logger response to pointing the vane toward the tower vertical support was 61.1°. This is within 0.9° of the target azimuth of 62.0°. The vane was then pointed along the support in the opposite direction. The data logger response read 241.0°, with the target azimuth of 242.0°. Another landmark was surveyed, a power pole with target azimuth readings of 184.5° and 4.5°. The data logger response to pointing the vane at the power pole was 183.3° and 3.2°, respectively. The wind direction sensor output was correctly aligned to true north with a magnetic declination of 3.5 degrees west of true north.

The linearity test of the wind direction sensor yielded results within the ±3° accuracy range of the sensor. Table 4 below presents the linearity calculations for the sensor. Average fixture bias through the range was 2.3°. In order to remove the bias of fixture misalignment, the system output measurement is bias-corrected. The bias-corrected linearity error varied from -1.2° to +1.2°. From Table 4, the bias-corrected output is within audit tolerances of ±3°.

Figure 1 presents a graph of this error over the fixture settings for the audit. The error is positive for azimuth bearings less than 180 degrees and negative for azimuth bearings over 180 degrees but all within the ±3° accuracy specification. The wind direction vane torque could not be measured because it was too windy but the sensor is new in good working order and turned freely.

The horizontal wind speed audit results were excellent with the site values matching the target audit values. The wind speed audit accuracy limits are ±(0.5 mph + 5% of observed). The starting torque for the horizontal wind speed sensor was measured at less than 0.2 gm-cm. The manufacturer-specified new instrument starting torque for the horizontal wind speed sensor is 0.3 gm-cm.

Audit results for the 2-meter temperature sensor was satisfactory. The 2-meter sensor response was within ±0.3°C of the audit temperatures which met the ±0.5°C acceptance limit.

A barometer is installed at Site 3. The barometer is manufactured by R.M. Young and is connected to the data logger system. Readings from an audit barometer were compared to the on-site pressure readings. The audit barometer is an electronic barometer manufactured by Druck, Model DPI-740. The audit and site barometer difference was -0.017 inches of mercury, well within the acceptable limit of ± 0.09 inches of mercury.

The result of the precipitation gauge audit was excellent. The audit measured a volume of 2.04 milliliters (ml) of water per tip whereas the manufacturer specified 2.0 ml of water per tip. In addition, according to the manufacturer, each tip represents 0.1 mm of precipitation and was correctly reported in the data logger output table.

Particulates

All the audit results for the particulate sampler were acceptable and are detailed in Table 3. The audit measured flows of 14.97, 16.69, and 18.52 lpm at the sampler reported rates of 15.0, 16.7 and 18.4 lpm, respectively. The percent differences of these flows are 0.2, 0.1 and -0.6, respectively. The audit acceptance is ±4.0 percent. The audit completed a leak test and self test and the results were passing.

The temperature and pressure sensors used by the BAM sampler were also audited and found to be within the audit specifications. The results of the temperature and pressure audit are detailed in Table 3.

4.0 CONCLUSIONS

This performance audit provides documentation of the current operating characteristics of the meteorological instrumentation and particulate sampling equipment. The meteorological audit results indicate that all instrumentation audited were operating within EPA-specified accuracies. All the particulate sampler audit results were within EPA-specified accuracies for flow, temperature and pressure.

Table 1
Audit Results
Bear Run Mine Site 1
Meteorological and Particulate Instrumentation
June 19, 2012

	Audit Value	Site Value	Difference	Audit Acceptance Limit
BAM Sampler				
Particulate Matter (10μm) Flow rate	14.81 alpm	15.0 alpm	1.3%	± 4%
	18.33 alpm	18.4 alpm	0.4%	
	16.55 alpm	16.7 alpm	0.9%	
Particulate Matter (10μm) Temperature	0.0°C	0.7°C	0.7°C	±2.0°C
	21.3°C	21.1°C	-0.2°C	
	43.4°C	43.1°C	-0.3°C	
Particulate Matter (10μm) Pressure	747.8 mm Hg	747 mm Hg	-0.8 mm Hg	±10 mm Hg
	747.9 mm Hg	747 mm Hg	-0.9 mm Hg	
	747.9 mm Hg	747 mm Hg	-0.9 mm Hg	
Tisch Sampler				
Flow Check	1.126 m^3/min	1.117 m^3/min	-0.8%	±7%
Design Rate Check	1.130 m^3/min	1.143 m^3/min	1.2%	±10%
Particulate Matter (10μm) Temperature	0.0°C	0.3°C	0.3°C	±2.0°C
	21.1°C	21.3°C	0.2°C	
	46.6°C	46.5°C	-0.1°C	
Particulate Matter (10μm) Pressure	747.6 mm Hg	740 mm Hg	-7.6 mm Hg	±10 mm Hg
	747.7 mm Hg	740 mm Hg	-7.7 mm Hg	
	747.7 mm Hg	740 mm Hg	-7.7 mm Hg	

Table 2
Audit Results
Bear Run Mine Site 2
Meteorological and Particulate Instrumentation
June 19, 2012

	Audit Value	Site Value	Difference	Audit Acceptance Limit
Particulate Matter (10µm) Flow rate	15.02 alpm	15.0 alpm	-0.1%	± 4%
	18.43 alpm	18.4 alpm	-0.2%	
	16.67 alpm	16.7 alpm	0.2%	
Particulate Matter (10µm) Temperature	0.9°C	0.8°C	-0.1°C	±2.0°C
	22.0°C	21.8°C	-0.2°C	
	41.3°C	41.3°C	0.0°C	
Particulate Matter (10µm) Pressure	748.5 mm Hg	747 mm Hg	-1.5 mm Hg	±10 mm Hg
	748.5 mm Hg	747 mm Hg	-1.5 mm Hg	
	748.5 mm Hg	747 mm Hg	-1.5 mm Hg	

Table 3
Audit Results
Bear Run Mine Site 3
Meteorological and Particulate Instrumentation
June 19, 2012

	Audit Value	Site Value	Difference	Audit Acceptance Limit
Wind Direction Orientation Azimuth	62.0°	61.1°	-0.9°	±5°
	242.0°	241.0°	-1.0°	
	184.5°	183.3°	-1.2°	
	4.5°	3.2°	-1.3°	
System Linearity Check (digital values are fixture bias-corrected, see Table 4 in text)	15.0° CW	16.2°	1.2°	±3°
	45.0° CW	45.8°	0.8°	
	90.0° CW	90.5°	0.5°	
	135.0° CW	136.2°	1.2°	
	180.0° CW	180.5°	0.5°	
	225.0° CW	224.4°	-0.6°	
	270.0° CW	268.8°	-1.2°	
	315.0° CW	313.8°	-1.2°	
	345.0° CW	343.9°	-1.1°	
Horizontal Wind Speed	0.0 mph	0.0 mph	0.0 mph	±(0.5 mph + 5% of Observed)
	3.4 mph	3.4 mph	0.0 mph	
	8.0 mph	8.0 mph	0.0 mph	
	13.7 mph	13.7 mph	0.0 mph	
	41.2 mph	41.2 mph	0.0 mph	
2-meter Temperature	0.0°C	0.0°C	0.0°C	± 0.5°C
	20.6°C	20.9°C	0.3°C	
	38.8°C	38.9°C	0.1°C	
Precipitation	2.04 ml/tip	2.00 ml/tip	2.0 %	± 10%
Barometric Pressure	29.477 in Hg	29.462 in Hg	-0.015 in Hg	±0.09 in Hg
	29.473 in Hg	29.457 in Hg	-0.016 in Hg	
	29.460 in Hg	29.440 in Hg	-0.020 in Hg	

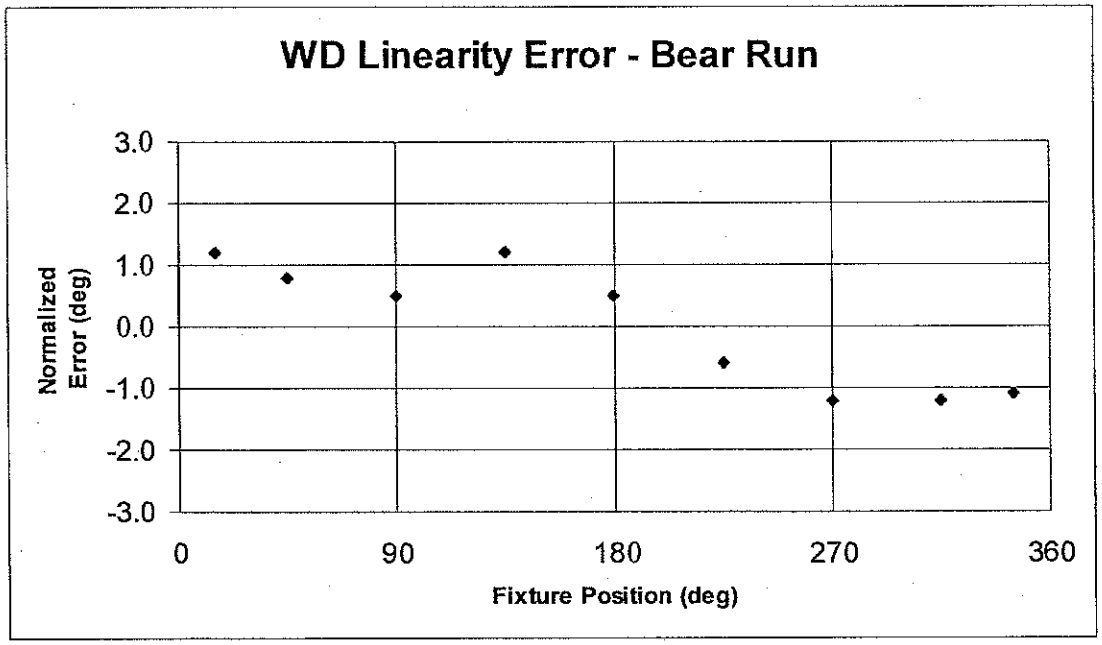
Table 3 (cont.)

	Audit Value	Site Value	Difference	Audit Acceptance Limit
Particulate Matter (10μm) Flow rate	14.97 alpm	15.0 alpm	0.2%	± 4%
	18.52 alpm	18.4 alpm	-0.6%	
	16.69 alpm	16.7 alpm	0.1%	
Particulate Matter (10μm) Temperature	0.0°C	0.3°C	0.3°C	±2.0°C
	23.0°C	23.0°C	0.0°C	
	39.8°C	39.7°C	-0.1°C	
Particulate Matter (10μm) Pressure	748.7 mm Hg	750 mm Hg	1.3 mm Hg	±10 mm Hg
	748.7 mm Hg	750 mm Hg	1.3 mm Hg	
	748.7 mm Hg	750 mm Hg	1.3 mm Hg	

Table 4
Wind Direction Linearity Check

Fixture Setting (A) (degrees)		System Output (B) (degrees)	Difference From Target (degrees)	Bias Corrected Output (BCO) B-C	Bias Corrected Linearity Error BCO-A
15	cw	18.5	3.5	16.2	1.2
45	cw	48.1	3.1	45.8	0.8
90	cw	92.8	2.8	90.5	0.5
135	cw	138.5	3.5	136.2	1.2
180	cw	182.8	2.8	180.5	0.5
225	cw	226.7	1.7	224.4	-0.6
270	cw	271.1	1.1	268.8	-1.2
315	cw	316.1	1.1	313.8	-1.2
345	cw	346.2	1.2	343.9	-1.1
Average Bias (C)			2.3		

Figure 1



ATTACHMENT A

METEOROLOGICAL AND PARTICULATE PERFORMANCE AUDIT DOCUMENTS

Jby CD
7/9/12

AUDIT PROCEDURE & WORKSHEET
FOR A MET ONE BAM-1020 PM_{10} MONITOR
(Using a BGI deltaCal)

Project: Bear Run Mine
Auditor: Jim Kuenning
Date/Time: 6/19/12 @ 0910 EST

Site: 1
Site Elevation: ~585'

	Make	Model	S/N
Sampler	Met One	BAM- 1020	N 5270
Sampler Thermometer	Met One	BX 596	N 5400
Audit Thermometer	BGI	deltaCal	457
Audit Barometer	BGI	deltaCal	457
Audit Flow Device	BGI	deltaCal	457

I. **Leak check:** Make sure pump is off. Connect the leak check device, BX-302 or BX-305. From the main menu, go to "TEST" then "TAPE" screen, advance the tape one window. From the main menu go to "TEST" then "PUMP" screen, turn on the pump. Make sure device is set to closed position. After a few seconds, look to see that the flow is below 1.5 LPM. Turn pump off. Remove leak check device.
PASS / FAIL circle one Flow: 0.2 LPM (should be less than 1.5 LPM)

II. **Self test:** From the main menu, go to "TAPE" then "SELF TEST". PASS / FAIL circle one

III. **Audit:** Connect the NIST-traceable reference flow measurement device. From the main menu, go to "TEST" then "FLOW" screen. Record the temperature and pressure readings in the "As Found" table. Using the "NEXT" hot key, scroll through the Ambient Temperature "AT" field and Barometric Pressure "BP" field. When you get the cursor to the "FLOW 1" field, the pump will start. Let the pump run for five minutes at the point, then record your readings. Repeat this procedure for all three flows.

	BAM	REFERENCE	% Diff	Difference
Ambient Temperature (AT °C)	See attached	Audit sheet		—
Barometric Pressure (BP mmHg)	See attached	Audit Sheet		—
Flow 1 Reading (15.0 LPM)	15.0	14.81	1.3	
Flow 2 Reading (18.4 LPM)	18.4	18.33	0.4	
Flow 3 Reading (16.7 LPM)	16.7	16.55	0.9	

Hit "EXIT" to return to Main Menu. Leave unit in Main Menu reading "Status: ON"

Record End Time _____

Comments: _____

✓ by CO 7/9/12

TEMPERATURE AUDIT FORM

Project Bear Run Mine
Date 06/19/12

Site 1
Auditor Jim Kuenzing

	Manufacturer	Model No.	Serial No.
Sensor	Met One	BX-596	N5400
Data Acquisition	Met One	BAM-1020	N5270
Audit Thermometer	Cooper	TM99A	C388421

✓

Sensor Height ~2 meter

Audit Point: Ice Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	845	1.2	0.0	
2	846	0.6	0.1	✓
3	847	0.6	0.0	
4	848	0.5	0.0	
5	849	0.5	0.0	Difference
Average		0.7	0.0	0.7 (°C)

Audit Point: Warm Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	852	20.9	21.2	
2	853	21.1	21.3	✓
3	854	21.1	21.3	
4	855	21.2	21.3	
5	856	21.2	21.3	Difference
Average		21.1	21.3	-0.2 (°C)

Audit Point: Hot Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	904	43.0	43.9	
2	0905	43.4	43.7	✓
3	906	43.1	43.3	
4	907	43.0	43.1	
5	908	42.9	43.0	Difference
Average		43.1	43.4	-0.3 (°C)

COMMENTS:

Offline: 845 EST

Online: 0910 EST

✓ by CD 7/9/12

BAROMETRIC PRESSURE AUDIT FORM

Project Bear Run Mine
Date 06/19/12

Site 1 ✓
Auditor Jim Kenning

	Manufacturer	Model No.	Serial No.
Site Sensor	Met One	BX 596	N5400
Data Acquis.	Met One	BAM-1020	N5270
Audit Barometer	DRUCK	DPI-740	740-01356

✓

Audit Barometer Certification Date: 01/17/12

Location of Sensor: On Barn, below inlet ✓

General Weather Conditions: Clear Sunny

System Inspection: Cable ok Sensor ok

TIME (EST)	Data Logger Reading (mm of Hg)	Field Audit Device		Difference (mm Hg)
		Reading (mm Hg)	Reading (—)	
843	747	747.8	—	-0.8
855	747	747.9	—	-0.9
901	747	747.9	—	-0.9

✓

Comments:

✓ by CD 7/9/12

PM_{10} & HIGH VOLUME SAMPLER AUDIT WORKSHEET
(For Volumetric-Flow Controlled Samplers)

Project/Site Location Bear Run Mine / Site 1
Date/Time 6/19/12 @ 933 EST
Auditor Jim Kuenning
Observer
Sampler No./ID "FRM"
Critical Flow Device S/N 6186
Sampler Type (circle one): Hi-Vol PM_{10}
Sampler's Last Calibration: Date 6/14/12
m_s= 7.4605, b_s= 0.4715 ✓

Site Elevation ~585'
Baro. Pres. (P_a) (mm Hg) 748
Barometer DRUCK DPI-740 740-01356
Temp. (T_a): (°C) 29.0° (K) ~~282.15~~ 302.15 JMK
Thermometer Cooper TM99A C388421
Manometer Meriam 350 SN 944880-P1
Audit Orifice Serial No. 8092479
Audit Orifice Certification Date 1/11/2012
m= 1.25985, b= -0.00749 ✓

Setup	ΔH Pressure Drop Across Orifice (in H_2O)	$Q_{a\text{-int}}$ From Orifice Calibration $Q_{a\text{-int}} = [(\Delta H)(T_a/P_a)]^{1/2}$	Q_a(audit) = (1/m){$Q_{a\text{-int}}$ – b}	ΔH_{cfd} Pressure Drop as Configured (in H_2O)	(mmHg)	$P_1 = P_a - \Delta H_{cfd}$ (mm Hg)	P_1/P_a	Q_a sampler = $[(P_1/P_a - b_s)T_a^{1/2}](1/m_s)$ (act m^3 min)
with orifice	4.93	1.411	1.126	19.60	36.61	711.39	.9511	1.117 ✓
without orifice				16.71	31.21	716.79	.9583	1.134 ✓

Audit Flow Rate Percentage Difference [2] -0.8 % ✓
Q_a (corrected Sampler) [3] ~~1.128~~ 1.143 JMK m^3/min ✓
Design Flow Rate Percentage Difference [4] ~~-0.4~~ 1.2 JMK % ✓

[2] Audit % Difference = [(Q_a(sampler) – Q_a(audit))/ Q_a(audit)] *100 where Q_a(sampler) is measured with the orifice installed

[3] Q_a(corrected sampler) = Q_a(sampler) * [(100 – Audit % Difference)/100] where Q_a(sampler) is measured without the orifice installed

[4] Design Flow Rate % difference = [(Q_a (corrected sampler)* - 1.13)/1.13] x 100

✓by OD 7/9/12

TEMPERATURE AUDIT FORM

Project Bear Run Mine
Date 6/19/12

Site 1
Auditor Jim Kuenning

	Manufacturer	Model No.	Serial No.
Sensor	Tisch Env.	TE-303TP	1401
Data Acquisition	Tisch Env.	TE-303TP	1401 ✓
Audit Thermometer	Cooper	TM99A	C38842

Sensor Height ~1 meter

Audit Point: Ice Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	753	0.2	0.0	
2	754	0.3	0.0	✓
3	755	0.3	0.0	
4	756	0.3	0.0	
5	757	0.3	0.0	Difference
Average		0.3	0.0	0.3 (°C)

Audit Point: Warm Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	759	21.2	21.1	
2	0800	21.3	21.1	✓
3	801	21.3	21.1	
4	802	21.3	21.1	
5	803	21.3	21.1	Difference
Average		21.3	21.1	0.2 (°C)

Audit Point: Hot Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	806	47.0	47.0	
2	807	46.5	46.7	✓
3	808	46.4	46.5	
4	809	46.3	46.5	
5	810	46.2	46.2	Difference
Average		46.5	46.6	~~0.0~~ -0.1 (°C)

JAK

COMMENTS:

Offline: 0750EST Online: 815EST

✓ by CD
7/9/12

BAROMETRIC PRESSURE AUDIT FORM

Project Bear Run Mine
Date 6/19/12

Site 1
Auditor Jim Kuenning ✓

	Manufacturer	Model No.	Serial No.
Site Sensor	Tisch	TE-303TP	1401
Data Acquis.	Tisch	TE-303TP	1401 ✓
Audit Barometer	DRUCK	DPI-740	740-01356

Audit Barometer Certification Date: 1/17/12

Location of Sensor: In Sampler ✓

General Weather Conditions: Clear, sunny

System Inspection: Cable ok Sensor ok

TIME (EST)	Data Logger Reading (mm of Hg)	Field Audit Device		Difference (mmHg)
		Reading (mmHg)	Reading (—)	
748	740	747.6	—	-7.6
758	740	747.7	—	-7.7 ✓
810	740	747.7	—	-7.7

Comments:

✓ by CD 7/~~19~~9/12

AUDIT PROCEDURE & WORKSHEET FOR A MET ONE BAM-1020 PM_{10} MONITOR
(Using a BGI deltaCal)

Project: Bear Run Mine
Auditor: Jim Kuenning
Date/Time: 6/19/12 @ 1042 EST

Site: 2 ✓
Site Elevation: ~585

	Make	Model	S/N
Sampler	Met One	BAM- 1020	N5275
Sampler Thermometer	Met One	BX-596	N5411
Audit Thermometer	BGI	deltaCal	457 ✓
Audit Barometer	BGI	deltaCal	457
Audit Flow Device	BGI	deltaCal	457

I. **Leak check:** Make sure pump is off. Connect the leak check device, BX-302 or BX-305. From the main menu, go to "TEST" then "TAPE" screen, advance the tape one window. From the main menu go to "TEST" then "PUMP" screen, turn on the pump. Make sure device is set to closed position. After a few seconds, look to see that the flow is below 1.5 LPM. Turn pump off. Remove leak check device. ✓

PASS / FAIL circle one Flow: 0.2 LPM (should be less than 1.5 LPM)

II. **Self test:** From the main menu, go to "TAPE" then "SELF TEST". PASS / FAIL circle one

III. **Audit:** Connect the NIST-traceable reference flow measurement device. From the main menu, go to "TEST" then "FLOW" screen. Record the temperature and pressure readings in the "As Found" table. Using the "NEXT" hot key, scroll through the Ambient Temperature "AT" field and Barometric Pressure "BP" field. When you get the cursor to the "FLOW 1" field, the pump will start. Let the pump run for five minutes at the point, then record your readings. Repeat this procedure for all three flows.

	BAM	REFERENCE	% Diff	Difference
Ambient Temperature (AT °C)	See attached Audit sheets			—
Barometric Pressure (BP mmHg)	See attached Audit Sheets			—
Flow 1 Reading (15.0 LPM)	15.0	15.02	-0.1	✓
Flow 2 Reading (18.4 LPM)	18.4	18.43	-0.2	✓
Flow 3 Reading (16.7 LPM)	16.7	16.67	0.2	✓

Hit "EXIT" to return to Main Menu. Leave unit in Main Menu reading "Status: ON"

Record End Time 1025 EST

Comments:

✓ by CD 7/9/12

TEMPERATURE AUDIT FORM

Project Bear Run Mine
Date 6/19/12

Site 2
Auditor Jim Kuenning

	Manufacturer	Model No.	Serial No.
Sensor	Met One	BX596	N5411
Data Acquisition	Met One	BAM1020	N5275 ✓
Audit Thermometer	Cooper	TM99A	C388421

Sensor Height ~2 meter

Audit Point: Ice Water Bath (ice melting)

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	1035	1.0	1.3	
2	1036	0.6	1.2	
3	1037	0.6	0.8	✓
4	1038	0.9	0.7	
5	1039	0.8	0.6	Difference
Average		0.8	0.9	-0.1 (°C)

Audit Point: Warm Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	1041	21.2	22.0	
2	1042	21.8	22.0	
3	1043	21.9	22.0	✓
4	1044	22.0	22.0	
5	1045	22.1	22.0	Difference
Average		21.8	22.0	-0.2 (°C)

Audit Point: Hot Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	1047	41.5	41.5	
2	1048	41.3	41.3	
3	1049	41.4	41.3	✓
4	1050	41.3	41.2	
5	1051	41.2	41.1	Difference
Average		41.3	41.3	0.0 (°C)

COMMENTS:

Offline: 1035 EST Online: 1052 EST

✓ by CD 7/9/12

BAROMETRIC PRESSURE AUDIT FORM

Project Bear Run Mine
Date 6/19/12

Site 2
Auditor Jim Kuenning

	Manufacturer	Model No.	Serial No.
Site Sensor	Met One	BX596	N5411
Data Acquis.	Met One	BAM 1020	N5275
Audit Barometer	DROCK	DPI-740	740-01356

✓

Audit Barometer Certification Date: 1/17/12

Location of Sensor: On BAM MAST ✓

General Weather Conditions: Clear sunny, breezy

System Inspection: Cable ok Sensor ok

TIME (EST)	Data Logger Reading (mm of Hg)	Field Audit Device		Difference (mm Hg)
		Reading (mm Hg)	Reading (—)	
1017	747	748.5	—	-1.5 ✓
1020	747	748.5	—	-1.5 ✓
1023	747	748.5	—	-1.5 ✓

Comments:

WIND DIRECTION AUDIT FORM

✓ by CD 7/9/12

	Manufacturer/ Model No.	Serial No.		
Sensor	RMYOUNG 5305-AQ	118969	Project	Bear Run Mine
Vane	RMYOUNG 5305-AQ	118969 gAK	Site	3
Digital Data Acq.	CSI CR1000	48322332	Sensor Height	~10 meter
Compass	SUUNTO KB14-360	113052	Date	6/19/12
Theodolite	—	—	Auditor	Jim Kuenning
Torque Watch	RM YOUNG VANE TORQUE GAUGE	—	Reading	Too Windy
Solar Sighting:	Time —	Azimuth —	Inclination	—

Magnetic Declination: 3.5° W of TN

Landmark #1 ~~65.5°~~ Tower Support
Azimuth ~~62.0~~ 65.5° gAK
Azimuth 62.0° (corrected)

Landmark #2 Power Poles
Azimuth 188.0°
Azimuth 184.5° (corrected)

Landmark #1				Landmark #2			
Target Azimuth (°)	Sensor-Data Acquisition System			Target Azimuth (°)	Sensor-Data Acquisition System		
	Azimuth (°)	Sine	Cosine		Azimuth (°)	Sine	Cosine
62.0	61.1	0.873	.482	184.5	183.3	-0.061	-0.999
242.0	241.0	-.878	-.481	4.5	~~32~~ 3.2 gAK	0.041	0.998

System Linearity Audit

Degree Wheel (Degrees)	Data Ac. System Readings (Deg)	Degree Wheel (Degrees)	Data Ac. System Readings (Deg)
15	18.5	225	226.7
45	48.1	270	271.1
90	92.8	315	316.1
135	138.5	345	346.2
180	182.8		

Offline: 1400 EST Online: 1435 EST

Vby OD
7/4/12

WIND SPEED AUDIT FORM

	Manufacturer	Model	Serial No.
Sensor	RMYOUNG	05305-AQ	118969
Cups/Propeller	RMYOUNG	8254	72383
Data Logger	CST	CR1000	48332
Test Device	RMYOUNG	18802	CA03051
Torque Watch	WATERS	366-3M	4385

Project: Bear Run Mine
Site: 3
Sensor Height: ~10 meter
Date: 6/19/12
Auditor: Jim Kuenning
Reading: < 0.2 gm-cm

DYNAMIC WIND SPEED CHECK

(Using Synchronous Motors or an Anemometer Drive)

1) 0 RPM = 0.0 mph
2) 300 RPM = 3.4 mph
3) 700 RPM = 8.0 mph
4) 1200 RPM = 13.7 mph
5) 3600 RPM = 41.2 mph

	Test WS (mph)	Data Logger (mph)	Difference (mph)
1.	0.0	0.0	0.0
2.	3.4	3.4	0.0
3.	8.0	8.0	0.0
4.	13.7	13.7	0.0
5.	41.2	41.2	0.0

Offline: 1400 EST

Online: 1435 EST

vby CD
7/9/12

TEMPERATURE AUDIT FORM

Project Bear Run Mine
Date 6/19/12

Site 3
Auditor Jim Kuenning

	Manufacturer	Model No.	Serial No.
Sensor	RMYOUNG	41342VC	21215
Data Acquisition	CSI	CR1000	48332
Audit Thermometer	Cooper	TM99A	~~C388321~~ C388421 JAK

Sensor Height ~2 meter

Audit Point: Ice Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	1335	0.0	0.0	0.0 0.0
2	1336	0.0	0.0	0.0 0.0
3	1337	0.0	0.0	0.0 0.0
4	1338	0.1	0.0	0.0 0.0
5	1339	0.1	0.0	Difference
Average		0.0	0.0	0.0 (°C)

0.0 0.0 0.0

Audit Point: Warm Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	1343	20.8	20.6	20.5 20.6
2	1344	20.9	20.6	20.6 20.6
3	1345	20.9	20.6	20.6 20.6
4	1346	20.9	20.7	20.6 20.7
5	1347	~~20.9~~ 26.0	20.7	Difference
Average		20.9	20.6	0.3 (°C)

20.7 20.7 20.7

Audit Point: Hot Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	1351	39.2	39.1	39.1 39.2
2	1352	39.1	39.0	39.0 39.0
3	1353	38.9	38.8	38.9 38.7
4	1354	38.7	38.6	38.7 38.6
5	1355	38.6	38.5	Difference
Average		38.9	38.8	0.1 (°C)

38.6 38.5 38.4

COMMENTS:

Offline: 1335 ~~MST~~ EST JAK

Online: 1355 EST

V by CD
7/9/12

BAROMETRIC PRESSURE AUDIT FORM

Project Bear Run Mine
Date 6/19/12

Site 3
Auditor Jim Kuenning

	Manufacturer	Model No.	Serial No.
Site Sensor	RM Young	61302V	BPA 4320
Data Acquis.	CSI	CR1000	48322332
Audit Barometer	DRUCK	DPI-740	740-01356

Audit Barometer Certification Date: 1/17/12

Location of Sensor: Inside Enclosure

General Weather Conditions: Clean

System Inspection: Cable New Sensor New

TIME (EST)	Data Logger Reading (in of Hg)	Field Audit Device		Difference (in Hg)
		Reading (in Hg)	Reading (—)	
1303	29.462	29.477	—	-0.015
1331	29.457	29.473	—	-0.016
1357	29.440	29.460	—	-0.020

JAK

Comments:

PRECIPITATION GAUGE AUDIT FORM

vby CD
7/9/12

Project Bear Run Mine
Site 3

Date/Time 6/19/12 @ 1254
Auditor Jim Kunning

	Make	Model No.	Serial No.
Gauge	RM YOUNG	S 2202	TB08835 ✓
Data Acquisition	CSI	CR1000	48332

Reference Volume Device Fisherbrand 10ml ✓
Volume of water per tip 2.0 ml (B) per manufacturer specifications
Each tip represents 0.1 mm of precipitation

Data Storage Location - CSI Data Logger *7 Channel No.: _____

Gauge & System Check (Trial 1) (for 4 tips)

No. of Tips	1	2	3	4	5	6	7	8	9	10	Totals
Volume of Water	8.10		7.90		8.20		8.20		8.25		40.65
Input per Tip (ml)		8.10		8.22		8.15		8.10		8.20	40.77

Total: 81.42

81.42 total H_2O volume (ml) = 2.04 ml H_2O/tip (A) ✓
40 ~~10~~ tips

% = $\frac{A - B}{B}$ x 100 = 2.0 % ✓

Number of tips measured by data logger: 40 (4.0 mm) ✓

Gauge & System Check (Trial 2, if needed)

No. of Tips	1	2	3	4	5	6	7	8	9	10	Totals
Volume of Water											
Input per Tip (ml)											

Total: —

— total H_2O volume (ml) = — ml H_2O/tip (A)
10 tips

% = $\frac{A - B}{B}$ x 100 = — %

Number of tips measured by data logger: _____

Comments: Tips 1254-1311, no test tips
40 tips total

✓ by CO
7/9/12

AUDIT PROCEDURE & WORKSHEET FOR A MET ONE BAM-1020 PM_{10} MONITOR
(Using a BGI deltaCal)

Project: Bear Run Mine
Auditor: Jim Kuenning
Date/Time: 6/19/12 @ 1158 EST

Site: 3
Site Elevation: ~585'

	Make	Model	S/N
Sampler	Met One	BAM- 1020	N5507
Sampler Thermometer	Met One	BX-596	N5405
Audit Thermometer	BGI	deltaCal	457
Audit Barometer	BGI	deltaCal	457
Audit Flow Device	BGI	deltaCal	457

I. **Leak check:** Make sure pump is off. Connect the leak check device, BX-302 or BX-305. From the main menu, go to "TEST" then "TAPE" screen, advance the tape one window. From the main menu go to "TEST" then "PUMP" screen, turn on the pump. Make sure device is set to closed position. After a few seconds, look to see that the flow is below 1.5 LPM. Turn pump off. Remove leak check device.
PASS / FAIL circle one Flow: 0.2 LPM (should be less than 1.5 LPM)

II. **Self test:** From the main menu, go to "TAPE" then "SELF TEST". PASS / FAIL circle one

III. **Audit:** Connect the NIST-traceable reference flow measurement device. From the main menu, go to "TEST" then "FLOW" screen. Record the temperature and pressure readings in the "As Found" table. Using the "NEXT" hot key, scroll through the Ambient Temperature "AT" field and Barometric Pressure "BP" field. When you get the cursor to the "FLOW 1" field, the pump will start. Let the pump run for five minutes at the point, then record your readings. Repeat this procedure for all three flows.

	BAM	REFERENCE	% Diff	Difference
Ambient Temperature (AT °C)	See attached	audit		—
Barometric Pressure (BP mmHg)	See attached	audit		—
Flow 1 Reading (15.0 LPM)	15.0	14.97	0.2	
Flow 2 Reading (18.4 LPM)	18.4	18.52	-0.6	
Flow 3 Reading (16.7 LPM)	16.7	16.69	0.1	

Hit "EXIT" to return to Main Menu. Leave unit in Main Menu reading "Status: ON"

Record End Time _____

Comments: _____

TEMPERATURE AUDIT FORM

vhy CD 7/9/12

Project Bear Run Mine
Date 6/19/12

Site 3
Auditor Jim Kuenning

	Manufacturer	Model No.	Serial No.
Sensor	Met One	BX596	N5405
Data Acquisition	Met One	BAM1020	N5507
Audit Thermometer	Cooper	TM99A	C388421

Sensor Height ~2 meter

Audit Point: Ice Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	1225	0.6	0.0	
2	1226	0.3	0.0	
3	1227	0.3	0.0	
4	1228	0.2	0.0	
5	1229	0.2	0.0	Difference
Average		0.3	0.0	0.3 (°C)

Audit Point: Warm Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	1232	22.8	22.9	
2	1233	23.0	23.0	
3	1234	23.0	23.0	
4	1235	23.1	23.0	
5	1236	23.1	23.0	Difference
Average		23.0	23.0	0.0 (°C)

Audit Point: Hot Water Bath

Reading	Time (EST)	Data Acq. System (°C)	Audit Thermometer (°C)	
1	1239	39.7	40.0	
2	1240	39.7	39.8	
3	1241	39.7	39.8	
4	1242	39.6	39.7	
5	1243	39.6	39.6	Difference
Average		39.7	39.8	-0.1 (°C)

COMMENTS:

Offline: 1225 EST

Online: 1243 EST

vby CD
7/9/12

BAROMETRIC PRESSURE AUDIT FORM

Project Bear Run Mine
Date 6/19/12

Site 3
Auditor Jim Kennedy

	Manufacturer	Model No.	Serial No.
Site Sensor	Met One	BX 596	N5405
Data Acquis.	Met One	BAM1020	N5507
Audit Barometer	DRUCK	DPI-740	740-01356

Audit Barometer Certification Date: 1/17/12

Location of Sensor: On BAM Mast

General Weather Conditions: Clear, Sunny, Breezy

System Inspection: Cable ok Sensor ok

TIME (EST)	Data Logger Reading (mm of Hg)	Field Audit Device		Difference (mm Hg)
		Reading (mmHg)	Reading (—)	
1208	750	748.7	—	1.3
1212	750	748.7	—	1.3
1216	750	748.7	—	1.3

Comments:

ATTACHMENT B

DOCUMENTATION OF

AUDIT INSTRUMENTATION CERTIFICATION

CERTIFICATE OF CALIBRATION AND TESTING

MODEL: **18802** (Comprised of Models 18820A Control Unit & 18830A Motor Assembly)
SERIAL NUMBER: CA03051

R. M. Young Company certifies that the above equipment was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating the measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

Nominal Motor Rpm	27106D Output Frequency Hz (1)	Calculated Rpm (1)	Indicated Rpm (2)
300	50	300	300
2700	450	2700	2700
5100	850	5100	5100
7500	1250	7500	7500
10,200	1700	10200	10200
12,600	2100	12600	12600
15,000	2500	15000	15000
☒ Clockwise and Counterclockwise rotation verified			

(1) Measured frequency output of RM Young Model 27106D standard anemometer attached to motor shaft 27106D produces 10 pulses per revolution of the anemometer shaft

(2) 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 Model: DP5740 SN: 4863

Date of inspection 1-10-12
Inspection Interval One Year

Tested By RP

McVEHIL-MONNETT ASSOCIATES, INC.
Air Quality ▪ Environmental Management

COMPASS CALIBRATION DOCUMENT

Date: 7/1/11

Technician: Ashley Mefferd

Calibration Location: South end of Inverness on high spot of Liberty Dr. 50 yrds west of airport fence

Magnetic Declination: ~ 9° E

Compass

Make: Suunto

Model: KB-14/360R

Serial Number: 113052

Instruments(s) Used for Calibration

Type and Make: Lietz / Sokkisha

Model and Serial Number: BT20 S/N 7969

Certified (attach certification): March 3, 2011

TEST DATA

Range	Landmark (Describe)	Calibration Instrument (Degrees)	Compass (Degrees)		Difference (Degrees)
			Actual	Corrected	
N (~0)	very east edge of office bldg to N	357.0	347.0	356.0	1.0
NE (~45)	east edge of hanger bldg	42.0	32.0	41.0	1.0
E (~90)	north leg of weather tower to E	91.5	81.5	90.5	1.0
SE (~135)	north edge of middle building to SW	135.0	125.5	134.5	0.5
S (~180)	east edge of rear building to south	186.0	176.5	185.5	0.5
SW (~225)	NE corner of the Marriott building, just E of red Marriott sign	225.5	216.5	225.5	0.0
W (~270)	light pole on I-25 south of the Interchange	272.0	262.5	271.5	0.5
NW (~315)	South side of tall support on Inverness water tower	318.5	309.0	318.0	0.5

Comments:

Ashley Mefferd
Technician Signature

Next Certification Due: June 2012

Rocky Mountain Lasers
Total Positioning Instruments
Since 1974

5385 Quebec Street, Commerce City, CO 80022 303-853-0311 800-293-9765 Fax: 303-853-0211
www.rockymountainlasers.com

CERTIFICATE OF CALIBRATION

To Whom It May Concern:

I hereby certify that the below listed equipment was checked and calibrated on a Sokkia Optical Collimation Range, and that Rocky Mountain Lasers & Instruments Service Technicians did make the necessary adjustments to said instrument to meet or exceed that of the manufacturer's specifications.

MANUFACTURER	Lietz Sokkisha
MODEL	BT-20 Transit
SERIAL NUMBER	7969
CALIBRATION DATE	March 3, 2011
CALIBRATION DUE DATE	March 2, 2012
TECHNICIAN	Kerry Kemper
REFERENCE	WO 7013449 McVehil-Monnett Associates, Inc.

Kerry Kemper

Kerry Kemper

Service Manager
Rocky Mountain Lasers

BGI INCORPORATED 58 GUINAN STREET WALTHAM, MA 02451
NIST Traceable Calibration Facility, Registered ISO 9001:2008

deltaCal

CERTIFICATE OF CALIBRATION - NIST TRACEBILITY

(Refer to instruction manual for further details of calibration)

deltaCal Serial Number: 000457 DATE 5-MAR-2012

Calibration Operator: Brian DeVoe

Critical Venturi Flow Meter: Max Uncertainty = 0.346%
Serial Number: 1A *CEESI NVLAP NIST Data File 07BGI-0001*
Serial Number: 2A *CEESI NVLAP NIST Data File 07BGI-0003*
Serial Number: 4A *CEESI NVLAP NIST Data File 07BGI-0002*

Room Temperature : Uncertainty = 0.071% Room Temperature: 22.1 C
Brand: *Brooklyn Thermometer* Serial Number: 9418
NIST Traceability No. 516837
deltaCal:
Ambient Temperature (set): 22.1 C
Aux (filter) Temperature (set): 22.1 C

Barometric Pressure and Absolute Pressure
Vaisala Model PTB331 Accuracy: 0.03176%
S/N D1430002
NIST Traceable Princo Cert. No. P-7485
deltaCal:
Barometric Pressure (set): **759** mm of Hg

Results of Venturi Calibration

Flow Rate (Q) vs. Pressure Drop (ΔP). Where: Q=Lpm, ΔP= Cm of H_2O

Q= 4.14360 ΔP ^ 0.53142

Overall Uncertainty: 0.35%

Date Placed In Service_____
(To be filled in by operator upon receipt)

Recommended Recalibration Date _____
(12 months from date placed in service)

Revised: July 2007

To Check a deltaCal 5-Mar-12 BD
2-20 Lpm VER 3.30P

BP= 759.42 mm of Hg
T= 22.1 C

Maximum allowable error at any flow rate is .75%.
Serial No. **457**

	Reading Abs. P Crit. Vent. mm of Hg	Crit. Vent. Temp	Q 760/20 Flow Lpm	QA Flow Lpm	QA deltaCal Indicated	% Error
# 2	258.33	21.4	2.87	2.90	2.90	**0.15**
	504.71	21.4	5.66	5.70	5.67	**-0.58**
# 1	255.06	21.4	9.91	9.99	9.93	**-0.64**
	415.43	21.4	16.27	16.40	16.41	**0.05**
	486.38	21.4	19.08	19.24	19.33	**0.49**
					Average %	**-0.11**

TISCH ENVIROMENTAL, INC.
145 SOUTH MIAMI AVE.
VILLAGE OF CLEVES, OH 45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX
WWW.TISCH-ENV.COM

AIR POLLUTION MONITORING EQUIPMENT

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Jan 11, 2012 Rootsmeter S/N 0438320 Ta (K) - 294
Operator Tisch Orifice I.D. - 8092479 Pa (mm) - 750.57

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.4040	3.3	2.00
2	NA	NA	1.00	0.9920	6.4	4.00
3	NA	NA	1.00	0.8870	7.9	5.00
4	NA	NA	1.00	0.8440	8.9	5.50
5	NA	NA	1.00	0.6960	13.0	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9966	0.7098	1.4149		0.9956	0.7091	0.8851
0.9924	1.0004	2.0010		0.9914	0.9994	1.2517
0.9904	1.1166	2.2372		0.9894	1.1154	1.3995
0.9891	1.1720	2.3464		0.9881	1.1708	1.4678
0.9837	1.4133	2.8299		0.9827	1.4119	1.7702

Qstd slope (m) = 2.01195
intercept (b) = -0.01198
coefficient (r) = 0.99999

Qa slope (m) = 1.25985
intercept (b) = -0.00749
coefficient (r) = 0.99999

y axis = SQRT[H2O(Pa/760)(298/Ta)]

y axis = SQRT[H2O(Ta/Pa)]

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}

Certificate of Traceability

*Fisher*brand®Class A Measuring Pipets

Cat.No. 13-665-3M **Serial Numbers:** 4430Y 4449Y 4422Y 4413Y 4425Y 4417Y

To Deliver 10 mL ± 0.03 mL

The design and calibration accuracy conforms to ASTM E1293-Standard Specification for Glass Measuring Pipets. The glass used in the manufacture conforms to ASTM E438, Type I glass.

The accuracy of the standards used for calibration are traceable to the National Institute of Standards and Technology under NIST Test No. 822/270236-04.

Melanie Cuddi

Certified By

050629

Certification Date

Manufactured by Fisher Scientific, Rochester, NY

Fisher Scientific

Certificate of Calibration

Tech Instrumentation

160 West Kiowa Avenue
Elizabeth, CO 80107
(303) 841-7567

Laboratory Test Number
45324

Date of Calibration
5/10/2012

Date Due
5/10/2013

Tested for: McVehil-Monnett Associates, Inc - Englewood, CO

PO Number: 900-Met-562

Instrument Under Test			
Manufacturer: Cooper Instruments		Mfgr. Spec'd Accuracy:	±0.3°F
Model: TM99A		As Received, this meter meets specifications (Y/N)	Y
Serial Number: c388421		After Calibration, This meter meets specifications (Y/N)	Y

Test Results - Thermometer Only - Resistive input to simulate an ideal probe

Simulated Temperature	Calibration as Received		After Calibration*	
-31.0°F / -35.0°C	-31.1	-35.1		
-22.0°F / -30.0°C	-22.1	-36.1		
5.0°F / -15.0°C	5.0	-15.0		
34.0°F / 1.1°C	33.9	1.1		
77.0°F / 25.0°C	77.0	25.0		
98.6°F / 37.0°C	98.6	37.0		
113.0°F / 45.0°C	113.0	45.0		
212.0°F / 100.0°C	212.0	100.0		
293.0°F / 145.0°C	292.0	144.4		

*Note: If no "After Calibration" data is provided, no adjustments were made to the calibration of the meter. The calibration was left "As Received".

SYSTEM CALIBRATION RESULTS -

The data below represents your system calibration -- Your thermometer with probe(s). Please note that since this is a system calibration, this certification is valid only with the specific probes tested. If you have multiple meters and/or probes, you must use care not to switch them. The accuracy of our system is at least 4 times better than the specified accuracy of your instrument, unless noted below. Our systems uncertainty used for this calibration is 0.037°F.

The standard used to verify the calibration of your system is a: Ertco-Eutechnics, Model 4400, S/N: 303002

Calibrated on 4/20/2012 Recall date 04/20/2013

Tech Instrumentation, Inc. certifies that your system meets or exceeds all published specifications unless otherwise noted in the comments section below. The calibration data below was obtained using measurement standards that are traceable to the National Institute of Standards and Technology (NIST) or natural physical constants, by immersing the probe in a constant temperature bath with our standard which determined the actual test temperature. The results stated on this report relate only to the items specifically identified. This report may not be reproduced except in full, without approval of Tech Instrumentation, Inc.

Test Procedure Used: TM99A Uncertainty Estimate: 0.037°F

Acceptance Criteria: Manufacturer's Specifications

Probe Model	1075	
Probe S/N	c388421	
	Degrees F	Degrees C
Bath Temp		-19.67
Probe Temp		-19.9
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Probe Model	1075	
Probe S/N	c388421	
	Degrees F	Degrees C
Bath Temp		10.66
Probe Temp		10.0
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Probe Model	1075	
Probe S/N	c388421	
	Degrees F	Degrees C
Bath Temp		40.00
Probe Temp		39.9
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		
Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Authorized Signature: Hanst Rossmueller II

Ambient Temperature: 71.5°F

Ambient RH: 29%

Comments:

Certificate of Calibration

The instrument listed below meets or exceeds 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. Cal-Tech Calibration conforms to the following, ISO/IEC 25/17025.

Customer: Mc Vehil-Monnett
Certificate Number: 6963
Instrument Make: Waters
Model: 366-3M
S/N: 4385
ID: n/a

Date: 07-21-11
Temp: 75 Deg f
Humidity: 44%
Rec. In Tol.
Due : 07-21-12
PO: 900-Met-562

This report may not be reproduced, except in full without written permission from Cal-Tech Calibration.

Certification by: J. D. Sears

Accuracy: +/- 5% of range.
Comments:
Procedure: F-1

Standards Used	Model	Certification Number	Due Date
Troemner	Weight Set	175994-1	05-13-12

gm-cm Range	As Found	After Adjust	Final Reading
0.40	0.4	none	0.4
0.8 0	0.8	none	0.8
1.20	1.19	none	1.19
1.60	1.59	none	1.59
2.00	1.98	none	1.98

Cal-Tech Calibration, Inc.
1314 FM 646 West /Ste. 15 / Dickinson, Texas 77539 /Phone 281-614-0050 / Fax 281-614-0046

McVEHIL-MONNETT ASSOCIATES, INC.
Air Quality • Environmental Management

CERTIFICATION DOCUMENT
For Altimeters and Handheld Barometers

Make: Druck
Serial Number: 740 01356
Model: DPI 740
Calibration Location: *MMA office @ 44 Inverness Dr. Englewood, CO*

Certified Against: Centennial Airport Flight Service Station (FSS) Altimeter. Readings provided by NOAA National Weather Service on their www.crh.noaa.gov web page.

TEST DATA

Time (MST)	Official Altimeter Reading (mb)	Official Altimeter Reading Corrected [1] (mb)	MMA Instrument Reading (mb)	Difference (mb)	MMA Instrument Adjusted To (mb)
0900	820.1	824.1	824.3	0.2	
1000	820.4	824.4	824.4	0.0	
1100	820.7	824.7	824.5	-0.2	
Avg.	—	824.4	824.4	0.0	N/A

Ray Roetman / 1/17/12
Technician / Date

TEST DATA @ 6 months

Time ( )	Official Altimeter Reading ( )	Official Altimeter Reading Corrected [1] ( )	MMA Instrument Reading ( )	Difference ( )	MMA Instrument Adjusted To ( )
Avg.					

/
Technician / Date

Comments: [1] Correction made for difference in elevation between Centennial FSS at 5883' ASL to MMA office at 5760' ASL. Correction factor is +4 mb.

Digital Manometer Calibration

Make/Model Meriam 350 Serial Number 944880-Y1

Date 6/15/12 Calibrated by G. Garman

VACUUM

Input (in. H_2O)	Digital reading (in. H_2O)	Difference (in. H_2O)
4.5	4.54	0.04
8.0	8.05	0.05
12.5	12.54	0.04
16.5	16.54	0.04
20.0	20.05	0.05
24.5	24.54	0.04
30.5	30.58	0.08

PRESSURE

Input (in. H_2O)	Digital reading (in. H_2O)	Difference (in. H_2O)
4.5	4.55	0.05
8.0	8.07	0.07
12.5	12.56	0.06
16.5	16.55	0.05
20.0	20.06	0.06
24.5	24.57	0.07
30.5	30.55	0.05

Digital instrument was calibrated against a 36-inch well-type manometer.

Next calibration due June 15, 2013

Appendix E
PM_{10} Field Blank for Tisch FRM Sampler

BEAR RUN MINE
Project # 2507-11

PM_{10} Particulate Filter Data Log
For Field Blanks
(Integrity Test)

Monitoring Month June 14 -July 13, 2012
Completed: 7/25/12

Filter Number	Site/Sampler	Date Filter Installed	Tare Weight (g)	Gross Weight (g)	Net Weight (mg)	Nominal Sample Volume (std.m³)	Integrity Concentration (ug/std.m³)
273704	Site 1 - Tisch FRM	6/25/12	4.5925	4.5940	1.5	1552	1.0

Average Difference (mg) = 1.5

Average equivalent concentration (ug/std.m³) = 1.0

To pass an integrity test, the average equivalent concentration for a set of field blanks must be less than ± 5 ug/m³.

Nominal sample volume is the lowest total standard flow volume recorded during this period for the sampler.

Appendix F
Meteorological Calibrations

WIND SPEED CALIBRATION FORM
(For a R.M. Young Wind Monitor)

	Manufacturer	Model No.	Serial No.
Sensor	R. M. Young	05305AQ	118969
Propeller	RM Young	08254	72383
Test Device	RM Young	Anemometer Drive 18820A/18830A	CA 03385
Data Acquis.	CSI	CR1000	48332

Project Bear Run Mine
Date/Time 6/10/12 0838-1005 EST
Sensor Height 10 m
Site 3
Technician Ray Roetman
Starting Torque <0.2 gm - cm CCW

I. System Inspection

Cable New Propeller New Bearings New (Pass/Fail)

II. Pre-adjustment System Linearity Check

Test Device (rpm)	Target (mph)	Data Logger Reading (mph)
0	0.00	0.00
300	3.43	3.43
900	10.3	10.3
1800	20.61	20.61
3600	41.22	41.22
5400	61.83	61.83

III. Adjustments (If necessary)

1) If needed, perform cleaning and maintenance
2) Describe any cleaning, maintenance or adjustments performed in the comments section.
New Starting Torque: _____

IV. Post-adjustment System Linearity Check

Test Device (rpm)	Target (mph)	Data Logger Reading (mph)
0		
300		
900		
1800		
3600		
5400		

N/A

Comments:

WIND DIRECTION CALIBRATION FORM
For a R.M. Young Wind Monitor

Project Bear Run Mine
Site 3
Date/Time 6/10/12 0830-1005 EST
Technician Roy Roetman
Sensor Height ~10 m
Mag. Declination 3.5°W

	Make	Model	Serial No.
Sensor	R.M. Young	05305AQ	118969
Compass	Suunto	KB-14/360	706163
Theodolite	N/A	N/A	N/A
Data Logger	CSI	CR1000	48322

I. System Inspection

Cable New Vane New Bearings New (Pass/Fail)

II. Sensor Orientation (Pre-adjustment)

Landmark NE tower leg Theodolite Azimuth N/A Compass Azimuth 64.0 Compass Az. (Corrected) 60.5

Landmark NW corner fence post w/ see com Theodolite Azimuth N/A Compass Azimuth 133.0 Compass Az. (Corrected) 129.5

Orientation (Deg.)	Azimuth (Degrees)	Data Logger Readings WD (Deg.)	(sine)	(cosine)
0 - 90	60.5	60.9	+.872	+.489
90 - 180	129.5	127.0	+.802	-.599
180 - 270	240.5	239.4	-.860	-.508
270 - 360	309.5	308.2	-.784	+.616

Agreement between target azimuth and system reading should be: ±5°

III. System Linearity Check (Pre-adjustment)

Degree Wheel (Degrees)	Data Logger Readings (Deg)	Degree Wheel (Degrees)	Data Logger Readings (Deg)
15	15.5	225	226.3
45	45.5	270	270.3
90	90.6	315	314.3
135	136.4	345	344.2
180	181.5		

No maintenance needed, so page 2 not used.

VLM 33 6/15/12

Form No. 2095D.1
Revision No. 2
Date 5/12
Page 1 of 1

BAROMETRIC PRESSURE CALIBRATION FORM

Project 2507-11 / Bear Run Mine
Date 6/5/12

Site 3 (upwind)
Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Site Sensor	R M Young	61302V	BPA4320
Data Acquis.	CSI	CR1000	48322
Field Barometer	BGI	Delta Cal	0490

Field Barometer Certification Date: 3/2/12

Location of Sensor: In logger enclosure ~1.5m AGL

I. System Inspection: Cable New Sensor New

II. Pre-adjustment System Check

TIME (EST)	Data Logger Reading (in of Hg)	Field Cal. Device		Difference (in Hg)
		Reading (mm Hg)	Reading (in Hg)	
1244	29.32	744.0	29.29	+0.03
1340	29.32	744.0	29.29	+0.03
1447	29.30	743.5	29.27	+0.03

III. Maintenance and Adjustments

1) If needed, complete maintenance, repairs and/or adjustments as per manufacturer's operation manual.
2) Describe any maintenance, repairs or adjustments in the Comments Section of the form.

IV. Post-adjustment System Check (if necessary) N/A

TIME ( )	Data Logger Reading (of Hg)	Field Cal. Device		Difference ( )
		Reading ( )	Reading ( )	

Comments:

TEMPERATURE CALIBRATION FORM

Project Boar Run Mine
Date/Time 6/5/12

Site 3 (upwind)
Technician Ray Roetman

	Manufacturer	Model No.	Serial No.
Sensor	RM Young	41342VC	21215
Data Acquisition	CSI	CR1000	48332
Ref. Thermometer	Cooper	TC100A	C306956

System Inspection: Cable New Sensor New Radiation Shield/Motor New (Pass/Fail)
List Weather Conditions (wind, sky cover) Partly cloudy (cumulus), warm breeze
Sensor Height ~2 m

Calibration Point: Ice H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1424	0.0	0.0	0.0/0.0/0.0
2	1425	+0.1	0.0	0.0/0.0/0.0
3	1426	+0.1	0.0	0.0/0.0/0.0
4	1427	0.0	0.0	0.0/0.0/0.0
5	1428	+0.1	0.0	0.0/Difference/0.0
Average		+0.1	0.0	+0.1 (°C)

Calibration Point: Warm H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1401	18.5	18.4	18.4/18.4/18.4
2	1402	18.5	18.4	18.4/18.4/18.4
3	1403	18.6	18.5	18.4/18.5/18.5
4	1404	18.6	18.5	18.5/18.5/18.5
5	1405	18.6	18.5	18.5/18.5/18.5
Average		18.6	18.5	+0.1 (°C)

Calibration Point: Hot H_2O Bath

Reading	Time (EST)	Data Acq. System (°C)	Ref. Thermometer (°C)	
1	1350	42.9	42.7	42.7/42.7/42.7
2	1351	42.8	42.6	42.7/42.6/42.6
3	1352	42.8	42.6	42.6/42.6/42.6
4	1353	42.7	42.5	42.6/42.5/42.5
5	1354	42.6	42.4	42.5 Difference/42.4/42.3
Average		42.8	42.6	+0.2 (°C)

If needed, perform cleaning and maintenance. Describe any work performed
COMMENTS:

PRECIPITATION GAUGE CALIBRATION FORM

Project Bear Run Mine **Date/Time** 6/6/12 1000-1045EST
Site 3 **Technician** Ray Roetman

	Make	Model No.	Serial No.
Gauge	RM Young	52202	TB08835
Data Acquisition	CSI	CR1000	48332

Reference Volume Device FisherBrand Class A 10mL by 1/10mL pipet S/N 4430A
Volume of water per tip 2.0 **ml (B) per manufacturer specifications**
Each tip represents 0.1 mm **of precipitation**

I. Electronics Check (preadjustment)

Number of Tips	0	25	Comments or Additional Test
Target Data Logger Reading (mm H_2O)	0.0	RA 2.5	—
Actual Data Logger Reading (mm H_2O)	0.0	2.6	Apparently one tip not cleanly completed & ∴ double counted
Difference (mm H_2O)	0.0	+0.1	
Time Interval on Data Logger (EST)	1000-1015	1015-1030	—

Data Storage Location on Data Logger: Data Table "Bear_Run_15min

II. Gauge & System Check (preadjustment)

1030-1045EST

No. of Tips	1	2	3	4	5	6	7	8	9	10	Totals
Volume of Water	8.35		9.70		9.60		10.00 +0.15				37.80
Input per Tip (ml)		10.00		10.05		10.00 +2.05		9.80			41.85
# of tip	4	5	5	5	5	6	5	5	=	40 Total:	79.65

79.65 / 40 ~~10~~ RA tips total H_2O volume (ml) = 1.99 ml H_2O/tip (A)

$\% = \frac{A - B}{B} \times 100$ = -0.5 %

Number of tips measured by data logger: 4.0 (=40 tips)

Appendix G
Certificates of Calibration - Meteorological Instrument Calibration Devices

CERTIFICATE OF CALIBRATION AND TESTING

MODEL: **18802** (Comprised of Models 18820A Control Unit & 18830A Motor Assembly)
SERIAL NUMBER: CA03385

R. M. Young Company certifies that the above equipment was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating the measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

Nominal Motor Rpm	27106D Output Frequency Hz (1)	Calculated Rpm (1)	Indicated Rpm (2)
300	50	300	300
2700	450	2700	2700
5100	850	5100	5100
7500	1250	7500	7500
10,200	1700	10200	10200
12,600	2100	12600	12600
15,000	2500	15000	15000
☒ Clockwise and Counterclockwise rotation verified			

(1) Measured frequency output of RM Young Model 27106D standard anemometer attached to motor shaft 27106D produces 10 pulses per revolution of the anemometer shaft
(2) Indicated on the Control Unit LCD display

* Indicates out of tolerance

☐ New Unit	☒ Service / Repair Unit	☐ As Found
	☒ No Calibration Adjustments Required	☐ As Left

Traceable frequency meter used in calibration Model: DP5740 SN: 4863

Date of inspection 30 Nov 2011
Inspection Interval One Year

Tested By SC

McVEHIL-MONNETT ASSOCIATES, INC.
Air Quality • Environmental Management

COMPASS CALIBRATION DOCUMENT

Date: 10-11-11

Technician: Ashley Mefferd

Calibration Location: Middle of Inverness high spot on Liberty Dr. 50 yrds. west of airport fence & wx tower

Magnetic Declination: ~9° E

Compass

Make: Suunto

Model: KB-14/360

Serial Number: 706163

CALS

Instruments(s) Used for Calibration

Type and Make: Leitz/Sokkisha

Model and Serial Number: BT20 S/N 7969

Certified (attach certification): March 3, 2011

TEST DATA

Range	Landmark (Describe)	Calibration Instrument (Degrees)	Compass (Degrees)		Difference (Degrees)
			Actual	Corrected	
N (~0)	very east edge of tan office bldg to north	358.0	348.0	357.0	1.0
NE (~45)	east edge of hangar bldg	43.0	34.0	43.0	Ø
E (~90)	flag pole in front of Liberty Media building	92.5	83.0	92.0	0.5
SE (~135)	light pole of Liberty Dr. to the SE	137.5	127.5	136.5	1.0
S (~180)	eastern most edge of close office bldg	184.5	175.0	184.0	0.5
SW (~225)	NE corner of Marriott bldg, just east of red sign	224.5	215.0	224.0	0.5
W (~270)	light pole on I-25 just south of interchange w/ 470	271.0	261.5	270.5	0.5
NW (~315)	Southside of tall support on Inverness water tower	318.0	308.5	317.5	0.5

Comments:

Ashley Mefferd
Technician Signature

Next Certification Due: October 2012

Rocky Mountain Lasers
Total Positioning Instruments
Since 1974

5385 Quebec Street, Commerce City, CO 80022 303-853-0311 800-293-9765 Fax: 303-853-0211
www.rockymountainlasers.com

CERTIFICATE OF CALIBRATION

To Whom It May Concern:

I hereby certify that the below listed equipment was checked and calibrated on a Sokkia Optical Collimation Range, and that Rocky Mountain Lasers & Instruments Service Technicians did make the necessary adjustments to said instrument to meet or exceed that of the manufacturer's specifications.

MANUFACTURER	Lietz Sokkisha
MODEL	BT-20 Transit
SERIAL NUMBER	7969
CALIBRATION DATE	March 3, 2011
CALIBRATION DUE DATE	March 2, 2012
TECHNICIAN	Kerry Kemper
REFERENCE	WO 7013449 McVehil-Monnett Associates, Inc.

Kerry Kemper

Kerry Kemper

Service Manager
Rocky Mountain Lasers

BGI INCORPORATED 58 GUINAN STREET WALTHAM, MA 02451
NIST Traceable Calibration Facility, Registered ISO 9001:2008

CERTIFICATE OF CALIBRATION - NIST TRACEBILITY

(Refer to instruction manual for further details of calibration)

deltaCal Serial Number: 000490 DATE 2-MAR-2012

Calibration Operator: Brian DeVoe

Critical Venturi Flow Meter: Max Uncertainty = 0.346%
Serial Number: 1A *CEESI NVLAP NIST Data File 07BGI-0001*
Serial Number: 2A *CEESI NVLAP NIST Data File 07BGI-0003*
Serial Number: 4A *CEESI NVLAP NIST Data File 07BGI-0002*

Room Temperature : Uncertainty = 0.071% Room Temperature: 22.7 C
Brand: *Brooklyn Thermometer* Serial Number: 9418
NIST Traceability No. 516837
deltaCal:
Ambient Temperature (set): 22.7 C
Aux (filter) Temperature (set): 22.7 C

Barometric Pressure and Absolute Pressure
Vaisala Model PTB331 Accuracy: 0.03176%
S/N D1430002
NIST Traceable Princo Cert. No. P-7485
deltaCal:
Barometric Pressure (set): **763** mm of Hg

Results of Venturi Calibration

Flow Rate (Q) vs. Pressure Drop (ΔP). Where: Q=Lpm, ΔP= Cm of H_2O

Q= 3.81336 ΔP ^ 0.51379

Overall Uncertainty: 0.35%

Date Placed In Service_____
(To be filled in by operator upon receipt)

Recommended Recalibration Date _____
(12 months from date placed in service)

Revised: July 2007

To Check a deltaCal 2-Mar-12 BD

2-20 Lpm VER-256X

BP= 763 mm of Hg

Maximum allowable error at any flow rate is .75%. T= 22.7 C

Serial No. **490**

	Reading Abs. P Crit. Vent. mm of Hg	Crit. Vent. Temp	Q 760/20 Flow Lpm	QA Flow Lpm	QA deltaCal Indicated	% Error
# 2	220.72	21.6	2.44	2.45	2.46	**0.37**
	494.43	21.6	5.52	5.55	5.53	**-0.33**
# 1	253.38	21.6	9.81	9.86	9.84	**-0.20**
	426.01	21.6	16.62	16.71	16.70	**-0.07**
	489.19	21.6	19.12	19.22	19.26	**0.21**
					Average %	**0.00**

Certificate of Calibration

Tech Instrumentation

160 West Kiowa Avenue
Elizabeth, CO 80107
(303) 841-7567

Date of Calibration
5/10/2012

Date Due
5/10/2013

Laboratory Test Number
45324

Tested for: McVehil-Monnett Associates, Inc - Englewood, CO

PO Number: 900-Met-582

Instrument Under Test			
Manufacturer: Cooper Instruments		Mfgr. Spec'd Accuracy:	±0.3°F
Model: TC100A		As Received, this meter meets specifications (Y/N)	Y
Serial Number: c306959		After Calibration, This meter meets specifications (Y/N)	Y

Test Results - Thermometer Only - Resistive Input to simulate an ideal probe

Simulated Temperature	Calibration as Received		After Calibration*	
-31.0°F / -35.0°C	-31.0	-35.0		
-22.0°F / -30.0°C	-22.1	-30.1		
5.0°F / -15.0°C	5.0	-15.0		
34.0°F / 1.1°C	34.0	1.1		
77.0°F / 25.0°C	77.0	25.0		
98.6°F / 37.0°C	99.6	37.0		
113.0°F / 45.0°C	113.0	45.0		
212.0°F / 100.0°C	212.1	100.1		
293.0°F / 145.0°C	292.0	144.4		

*Note: If no "After Calibration" data is provided, no adjustments were made to the calibration of the meter. The calibration was left "As Received".

SYSTEM CALIBRATION RESULTS -

The data below represents your system calibration – Your thermometer with probe(s). Please note that since this is a system calibration, this certification is valid only with the specific probes tested. If you have multiple meters and/or probes, you must use care not to switch them. The accuracy of our system is at least 4 times better than the specified accuracy of your instrument, unless noted below. Our systems uncertainty used for this calibration is 0.037°F.

The standard used to verify the calibration of your system is a: Ertco-Eutechnics, Model 4400, S/N: 303082

Calibrated on 4/20/2012 Recall date 04/20/2013

Tech Instrumentation, Inc. certifies that your system meets or exceeds all published specifications unless otherwise noted in the comments section below. The calibration data below was obtained using measurement standards that are traceable to the National Institute of Standards and Technology (NIST) or natural physical constants, by immersing the probe in a constant temperature bath with our standard which determined the actual test temperature. The results stated on this report relate only to the items specifically identified. This report may not be reproduced except in full, without approval of Tech Instrumentation, Inc.

Test Procedure Used: TM99A Uncertainty Estimate: 0.037°F

Acceptance Criteria: Manufacturer's Specifications

Probe Model	1075	
Probe S/N	c306956	
	Degrees F	Degrees C
Bath Temp		-19.97
Probe Temp		-20.0

Probe Model	1075	
Probe S/N	c306956	
	Degrees F	Degrees C
Bath Temp		10.00
Probe Temp		10.0

Probe Model	1075	
Probe S/N	c306956	
	Degrees F	Degrees C
Bath Temp		39.99
Probe Temp		39.9

Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Probe Model		
Probe S/N		
	Degrees F	Degrees C
Bath Temp		
Probe Temp		

Authorized Signature: Herst Roasmueller II

Ambient Temperature: 71.5°F
Ambient RH: 29%

Comments:

Certificate of Traceability

*Fisher*brand®Class A Measuring Pipets

Cat.No. 13-665-3M

To Deliver 10 mL ± 0.03 mL

Serial Numbers: 4430U 4449U 4422U 4413U 4425U 4417U

The design and calibration accuracy conforms to ASTM E1293-Standard Specification for Glass Measuring Pipets. The glass used in the manufacture conforms to ASTM E438, Type I glass.

The accuracy of the standards used for calibration are traceable to the National Institute of Standards and Technology under NIST Test No. 822/270236-04.

Melanie Cordelli

Certified By

050629

Certification Date

Manufactured by Fisher Scientific, Rochester, NY

Fisher Scientific