

# **Buckskin Mine Ambient Air Monitoring Network**

## **4<sup>th</sup> Quarter 2006**

Prepared by:



*IML Air Science*  
a division of Inter-Mountain Laboratories, Inc.  
555 Absaraka  
Sheridan, Wyoming 82801  
(307) 674-7506  
[www.imlairscience.com](http://www.imlairscience.com)



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## REPORT SUMMARY

### Network Operation

This particulate and meteorological monitoring network is operated in accordance with Buckskin Mine Quality Assurance Project Plan (QAPP) submitted in March 2001. Ambient particulate data are collected at two sites (North Site and West Site). The network consists of two low volume R&P TEOM PM<sub>10</sub> continuous particulate monitors (N-TEOM and W-TEOM). The meteorological station is located at the North Site.

Routine service and quality assurance audits were performed on both the N-TEOM and W-TEOM PM<sub>10</sub> monitors this quarter. Quality assurance audit details are located in Appendix C.

### Results

No 24-hour PM<sub>10</sub> concentrations exceeded 150 µg/m<sup>3</sup> this quarter. Refer to Appendix A for more particulate sample information.

Year-to-date statistics for the samplers are as follows:

#### **2006 annual statistics at STP**

Parameter	Concentration (µg/m <sup>3</sup> )	
	N-TEOM	W-TEOM
Mean YTD	21.9	18.7
High 24-hour	101.3	63.7
2nd High 24-hour	84.7	58.6

#### **2006 annual statistics at LTP**

Parameter	Concentration (µg/m <sup>3</sup> )	
	N-TEOM	W-TEOM
Mean YTD	19.5	16.8
99th Percentile 24-hour	61.3	49.4

Meteorological monitoring results are presented in Appendix B.

### **Data Recovery**

The North TEOM monitor had a data recovery rate of 97.8% this quarter. Two days of data in December were invalidated due to flow faults. The West TEOM had 85.9% data recovery this quarter. Thirteen days of data were invalidated after a temporary power surge or outage on October 27. The surge/outage locked up the TEOM control unit until November 8 when Buckskin personnel installed a power supply/surge protector.

### **Particulate Monitor Data Recovery (%)**

<b>Period</b>	<b>N-TEOM</b>	<b>W-TEOM</b>
4 <sup>th</sup> Quarter	97.8	85.9
2006 (YTD)	97.8	87.4

Meteorological data recovery was 100% this quarter.

### **Meteorological Data Recovery (%)**

<b>Period</b>	<b>Wind Speed</b>	<b>Wind Direction</b>	<b><math>\sigma_{\theta}</math></b>	<b>Temp</b>	<b>Precipitation</b>
4 <sup>th</sup> Quarter	100	100	100	100	100
2006 (YTD)	94.09	94.09	94.09	93.92	94.09

# **Appendix A**

## Particulate Data

Daily TEOM PM<sub>10</sub> concentrations  
Precision data for TEOM samplers

# Buckskin Mine - North TEOM

4th Quarter 2006

Daily Average TEOM Concentrations (microgram/cubic meter)

October			November			December		
	STP	LTP		STP	LTP		STP	LTP
10/1/2006	28.2	25.0	11/1/2006	13.6	13.2	12/1/2006	18.6	18.2
10/2/2006	32.7	29.2	11/2/2006	58.2	53.9	12/2/2006	11.4	11.3
10/3/2006	12.4	11.4	11/3/2006	44.3	40.8	12/3/2006	14.3	13.5
10/4/2006	16.5	14.9	11/4/2006	13.9	12.9	12/4/2006	30.4	27.9
10/5/2006	21.8	18.8	11/5/2006	18.8	17.2	12/5/2006	10.9	10.4
10/6/2006	16.3	14.2	11/6/2006	15.1	13.5	12/6/2006	10.4	10.0
10/7/2006	9.3	8.4	11/7/2006	14.2	12.4	12/7/2006	14.7	13.6
10/8/2006	14.7	13.5	11/8/2006	9.2	8.4	12/8/2006	14.6	13.4
10/9/2006	12.2	11.4	11/9/2006	4.9	4.6	12/9/2006	17.3	16.0
10/10/2006	4.7	4.3	11/10/2006	5.8	5.4	12/10/2006	14.5	13.5
10/11/2006	4.6	4.4	11/11/2006	14.9	13.6	12/11/2006	16.1	14.9
10/12/2006	6.5	6.1	11/12/2006	3.8	3.5	12/12/2006	22.1	20.4
10/13/2006	12.6	11.8	11/13/2006	9.7	8.7	12/13/2006	26.4	24.0
10/14/2006	27.7	25.1	11/14/2006	9.1	8.5	12/14/2006	31.6	29.2
10/15/2006	14.8	13.0	11/15/2006	6.8	6.2	12/15/2006	26.8	24.6
10/16/2006	10.6	9.7	11/16/2006	14.3	13.2	12/16/2006	10.4	10.0
10/17/2006	4.2	4.0	11/17/2006	15.7	14.5	12/17/2006	13.3	12.8
10/18/2006	7.1	6.5	11/18/2006	12.7	11.9	12/18/2006	24.7	23.6
10/19/2006	8.4	7.5	11/19/2006	26.4	24.0	12/19/2006	63.6	60.0
10/20/2006	7.3	6.8	11/20/2006	17.2	15.8	12/20/2006	18.0	17.2
10/21/2006	4.6	4.3	11/21/2006	17.8	15.9	12/21/2006		
10/22/2006	4.7	4.4	11/22/2006	21.0	19.0	12/22/2006	14.9	14.0
10/23/2006	7.4	6.8	11/23/2006	18.7	17.6	12/23/2006	13.1	12.1
10/24/2006	15.6	14.1	11/24/2006	10.4	9.7	12/24/2006	10.7	10.4
10/25/2006	16.0	14.8	11/25/2006	14.6	13.9	12/25/2006	20.0	18.3
10/26/2006	6.7	6.2	11/26/2006	16.0	15.1	12/26/2006	27.8	25.4
10/27/2006	8.7	8.0	11/27/2006	40.9	38.8	12/27/2006	34.1	31.1
10/28/2006	11.1	10.0	11/28/2006	16.9	17.0	12/28/2006	29.4	28.2
10/29/2006	7.6	6.9	11/29/2006	17.1	16.9	12/29/2006	6.4	6.1
10/30/2006	9.3	9.1	11/30/2006	46.8	44.3	12/30/2006		
10/31/2006	18.8	18.1				12/31/2006	23.8	22.4

## TEOM Summary Statistics

October			November			December		
	STP	LTP		STP	LTP		STP	LTP
Mean	12.4	11.2	Mean	18.3	17.0	Mean	20.4	19.1
High	32.7	29.2	High	58.2	53.9	High	63.6	60.0
2nd High	28.2	25.1	2nd High	46.8	44.3	2nd High	34.1	31.1
Recovery	100.0%		Recovery	100.0%		Recovery	93.5%	

## 4th Quarter 2006

	STP	LTP
Mean	16.9	15.7
High	63.6	60.0
2nd High	58.2	53.9
Recovery	97.8%	

# Buckskin Mine - West TEOM

4th Quarter 2006

Daily Average TEOM Concentrations (microgram/cubic meter)

October			November			December		
	STP	LTP		STP	LTP		STP	LTP
10/1/2006	23.4	20.8	11/1/2006			12/1/2006	18.4	17.6
10/2/2006	28.7	25.8	11/2/2006			12/2/2006	13.8	13.6
10/3/2006	13.0	12.1	11/3/2006			12/3/2006	9.1	8.7
10/4/2006	13.7	12.5	11/4/2006			12/4/2006	18.5	17.0
10/5/2006	16.4	14.3	11/5/2006			12/5/2006	13.3	12.7
10/6/2006	15.2	13.5	11/6/2006			12/6/2006	8.9	8.6
10/7/2006	9.9	9.1	11/7/2006			12/7/2006	10.1	9.4
10/8/2006	10.7	9.9	11/8/2006			12/8/2006	14.1	13.0
10/9/2006	10.2	9.7	11/9/2006	5.0	4.6	12/9/2006	16.5	15.2
10/10/2006	5.4	4.9	11/10/2006	4.5	4.2	12/10/2006	14.9	13.9
10/11/2006	3.8	3.6	11/11/2006	11.8	10.9	12/11/2006	17.2	16.2
10/12/2006	6.7	6.3	11/12/2006	4.6	4.3	12/12/2006	19.1	17.6
10/13/2006	8.1	7.6	11/13/2006	12.9	11.7	12/13/2006	24.4	22.4
10/14/2006	18.1	16.4	11/14/2006	10.4	9.6	12/14/2006	26.5	24.7
10/15/2006	12.4	10.8	11/15/2006	6.3	5.7	12/15/2006	24.8	23.0
10/16/2006	11.4	10.6	11/16/2006	13.6	12.5	12/16/2006	9.5	9.2
10/17/2006	4.3	4.1	11/17/2006	14.7	13.7	12/17/2006	12.7	12.4
10/18/2006	5.9	5.4	11/18/2006	10.4	9.8	12/18/2006	13.7	13.2
10/19/2006	7.0	6.3	11/19/2006	14.5	13.3	12/19/2006	39.0	36.9
10/20/2006	5.6	5.2	11/20/2006	16.2	14.9	12/20/2006	28.1	27.0
10/21/2006	5.5	5.2	11/21/2006	14.3	12.9	12/21/2006	31.7	30.0
10/22/2006	4.8	4.5	11/22/2006	19.5	17.9	12/22/2006	18.8	17.9
10/23/2006	7.0	6.4	11/23/2006	17.5	16.6	12/23/2006	11.3	10.5
10/24/2006	12.8	11.6	11/24/2006	9.5	9.0	12/24/2006	10.0	9.7
10/25/2006	13.9	13.0	11/25/2006	15.0	14.4	12/25/2006	10.2	9.5
10/26/2006	6.9	6.4	11/26/2006	13.9	13.3	12/26/2006	16.3	15.0
10/27/2006			11/27/2006	21.1	20.2	12/27/2006	26.8	24.6
10/28/2006			11/28/2006	20.2	20.5	12/28/2006	18.8	18.2
10/29/2006			11/29/2006	17.0	17.0	12/29/2006	4.7	4.7
10/30/2006			11/30/2006	34.5	33.0	12/30/2006	12.0	11.5
10/31/2006						12/31/2006	13.8	13.2

## TEOM Summary Statistics

October			November			December		
	STP	LTP		STP	LTP		STP	LTP
Mean	10.8	9.8	Mean	14.0	13.2	Mean	17.0	16.0
High	28.7	25.8	High	34.5	33.0	High	39.0	36.9
2nd High	23.4	20.8	2nd High	21.1	20.5	2nd High	31.7	30.0
Recovery	83.9%		Recovery	73.3%		Recovery	100.0%	

## 4th Quarter 2006

	STP	LTP
Mean	14.1	13.2
High	39.0	36.9
2nd High	34.5	33.0
Recovery	85.9%	

# PM<sub>10</sub> Precision, Automated Method

Site: Buckskin North  
Instrument: R&P 1400a TEOM

4th Quarter 2006

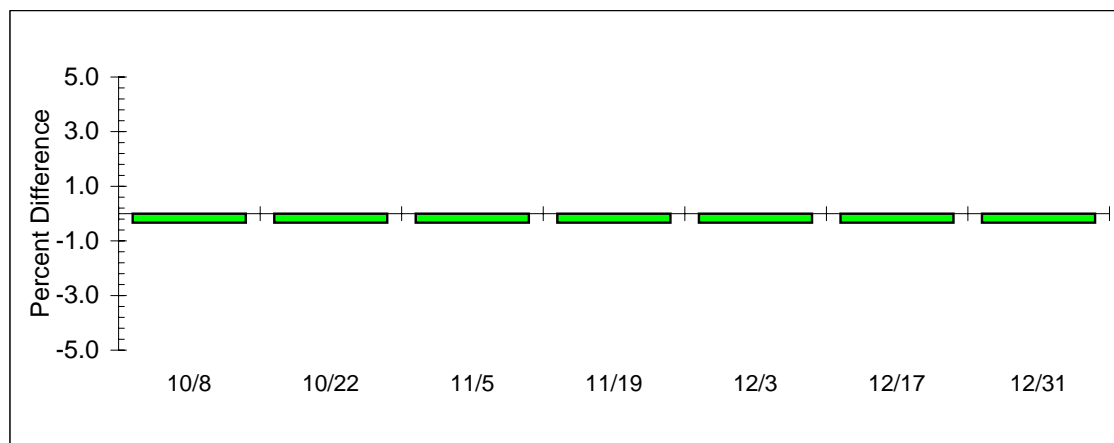
## Mass Sensor Flow Rate (liters/minute)

Date	10/8	10/22	11/5	11/19	12/3	12/17	12/31
Design Flow	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Indicated Hourly Average Flow	2.99	2.99	2.99	2.99	2.99	2.99	2.99
<b>%Diff.</b>	<b>-0.3</b>	<b>-0.3</b>	<b>-0.3</b>	<b>-0.3</b>	<b>-0.3</b>	<b>-0.3</b>	<b>-0.3</b>

Percent Difference =  $((Y - X) / X) * 100$

X = Design Flow

Y = Indicated Hourly Average Flow



### Statistical Calculations

n=	7	Upper 95% Probability Limit=	-0.3 %
Sum=	-2.3 %	Lower 95% Probability Limit=	-0.3 %
Mean =	-0.3 %		
S Dev=	0 %		

Reference: 40 CFR 58, Appendix A, Sections 3.1 & 5.1

*Precision of Automated Methods Excluding PM<sub>2.5</sub>, Alternative Procedure*

# PM<sub>10</sub> Precision, Automated Method

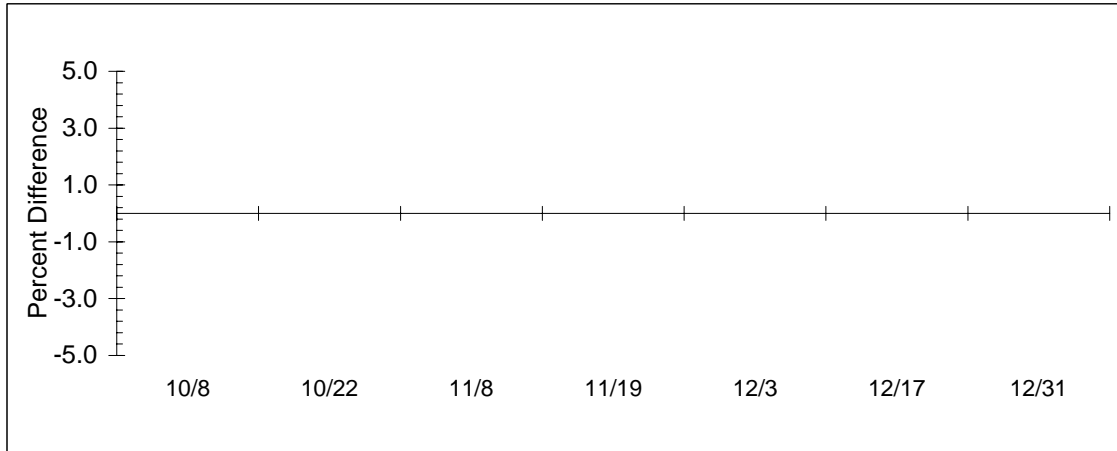
Site: Buckskin West  
Instrument: R&P 1400a TEOM

4th Quarter 2006

## Mass Sensor Flow Rate (liters/minute)

Date	10/8	10/22	11/8	11/19	12/3	12/17	12/31
Design Flow	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Indicated Hourly Average Flow	3.00	3.00	3.00	3.00	3.00	3.00	3.00
<b>%Diff.</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

Percent Difference =  $((Y - X) / X) * 100$       X = Design Flow      Y = Indicated Hourly Average Flow



### Statistical Calculations

n=	7	Upper 95% Probability Limit=	0.0 %
Sum=	0.0 %	Lower 95% Probability Limit=	0.0 %
Mean =	0.0 %		
S Dev=	0 %		

Reference: 40 CFR 58, Appendix A, Sections 3.1 & 5.1

*Precision of Automated Methods Excluding PM<sub>2.5</sub>, Alternative Procedure*

## **Appendix B**

### Meteorological Data

Annual Meteorological Summary  
Quarterly Meteorological Summaries  
Annual Wind Rose  
Quarterly Wind Rose  
Annual Joint Frequency Distribution

# Buckskin Mine

## Meteorological Data Summary

1/1/2006 - 12/31/2006

### Hourly Data

	<b>Average/Total</b>	<b>Max</b>	<b>Min</b>
Wind Speed (mph)	10.9	39.5	0.5
Sigma-Theta (°)	12.3	73.0	1.9
Temperature (F)	48.0	103.1	-22.4
Precipitation (in)	9.35	1.04	

Predominant wind direction was from the SSW sector,  
accounting for 13.8% of the possible winds

### Data Recovery

<b>Parameter</b>	<b>Possible</b> (hours)	<b>Reported</b> (hours)	<b>Recovery</b>
Wind Speed	8760	8242	94.09%
Wind Direction	8760	8242	94.09%
Sigma-Theta	8760	8242	94.09%
Temperature	8760	8227	93.92%
Precipitation	8760	8242	94.09%

# Buckskin Mine

## Meteorological Data Summary

10/1/2006 - 12/31/2006

### Hourly Data

	<b>Average/Total</b>	<b>Max</b>	<b>Min</b>
Wind Speed (mph)	10.8	34.5	1.0
Sigma-Theta (°)	9.9	57.9	1.9
Temperature (F)	34.7	78.6	-6.8
Precipitation (in)	1.08	0.16	

Predominant wind direction was from the SSW sector,  
accounting for 17.8% of the possible winds

### Data Recovery

<b>Parameter</b>	<b>Possible</b> (hours)	<b>Reported</b> (hours)	<b>Recovery</b>
Wind Speed	2208	2208	100.00%
Wind Direction	2208	2208	100.00%
Sigma-Theta	2208	2208	100.00%
Temperature	2208	2208	100.00%
Precipitation	2208	2208	100.00%



**Wind Rose -- 2006**  
**Buckskin Mine -- Gillette, WY**  
1/1/2006 Hr. 1 to 12/31/2006 Hr. 24

**RELATIVE FREQUENCY (% of Recorded Winds) TABLE**

Wind Direction	mph						Row Total
	0.0- 4.0	4.0- 7.4	7.4-12.1	12.1-19.0	19.0-25.8	25.8-100.0	
0.0 deg.(North)	0.3	1.1	1.9	1.2	0.3	0.0	4.8
22.5 deg.	0.2	1.0	1.7	0.8	0.1	0.0	3.9
45.0 deg.	0.2	1.2	1.3	0.6	0.0	0.0	3.4
67.5 deg.	0.3	1.3	0.9	0.3	0.0		2.8
90.0 deg.	0.3	1.0	0.7	0.1	0.0		2.1
112.5 deg.	0.3	0.6	0.6	0.2	0.0		1.7
135.0 deg.	0.4	0.9	1.2	0.8	0.3		3.5
157.5 deg.	0.8	1.6	2.5	3.7	1.7	0.1	10.3
180.0 deg.	1.4	3.7	4.3	2.3	0.4	0.0	12.1
202.5 deg.	1.8	5.7	4.0	1.8	0.4	0.1	13.8
225.0 deg.	0.8	1.7	2.0	2.1	1.4	0.4	8.3
247.5 deg.	0.4	1.0	0.8	0.3	0.2	0.0	2.8
270.0 deg.	0.5	1.2	1.3	0.3	0.1	0.0	3.4
292.5 deg.	0.3	1.1	2.3	1.5	0.2	0.1	5.6
315.0 deg.	0.2	1.5	2.4	3.8	1.9	1.0	10.9
337.5 deg.	0.3	1.1	3.0	3.7	2.1	0.3	10.5
	8.5	25.7	31.0	23.6	9.1	2.1	100.0

0 mph ( 1.0%)

INVALID READINGS 518

NUMBER OF POSSIBLE READINGS 8760

VALID READINGS 8242

DATA CAPTURE 94.09%



**Wind Rose -- 4th Quarter 2006**  
**Buckskin Mine -- Gillette, WY**  
 10/1/2006 Hr. 1 to 12/31/2006 Hr. 24

**RELATIVE FREQUENCY (% of Recorded Winds) TABLE**

Wind Direction	mph						Row Total
	0.0- 4.0	4.0- 7.4	7.4-12.1	12.1-19.0	19.0-25.8	25.8-100.0	
0.0 deg.(North)	0.4	0.8	1.1	0.7	0.3		3.3
22.5 deg.	0.2	0.6	0.6	0.3			1.7
45.0 deg.	0.2	0.7	0.6	0.3			1.8
67.5 deg.	0.1	0.4	0.7	0.1			1.3
90.0 deg.	0.3	0.8	0.3				1.4
112.5 deg.	0.2	0.2	0.2	0.1			0.7
135.0 deg.	0.3	0.4	0.5	0.2			1.4
157.5 deg.	0.7	1.6	1.4	2.1	1.2	0.1	7.2
180.0 deg.	1.1	4.5	5.9	3.0	0.6	0.1	15.3
202.5 deg.	1.9	6.5	6.0	2.7	0.5	0.1	17.8
225.0 deg.	1.2	1.8	2.4	2.5	1.5	1.0	10.3
247.5 deg.	0.3	1.4	0.8	0.2	0.2	0.1	3.1
270.0 deg.	0.7	1.8	1.8	0.1	0.0		4.4
292.5 deg.	0.4	1.5	2.8	1.5	0.1	0.0	6.3
315.0 deg.	0.3	1.8	2.7	4.1	2.3	0.1	11.3
337.5 deg.	0.5	1.3	3.3	5.0	2.6	0.1	12.8
	8.8	26.2	31.0	22.9	9.3	1.8	100.0

0 mph ( 1.0%)

INVALID READINGS 0

NUMBER OF POSSIBLE READINGS 2208

VALID READINGS 2208

DATA CAPTURE 100.00%

Buckskin Mine  
Gillette, WY

Frequency Distribution  
Hourly Average Wind Speed, Wind Direction and Sigma

IML Air Science  
Sheridan, WY

Calm Readings 0      Total Readings 8242      Possible Readings 8760      Data Capture 94.1%

From 1/1/2006 To 12/31/2006

**Stability Class A**

**Wind Speed (Knots)**

Direction	0.6 - 3.0	4 - 6	7 - 10	11-16	17 - 21	> 21	Row Total
E	0.00158	0.00364	0.00085				0.00607
ENE	0.00146	0.00425	0.00085				0.00655
ESE	0.00073	0.00194	0.00024				0.00291
N	0.00121	0.00413	0.00267	0.00024	0.00012		0.00837
NE	0.00085	0.00413	0.00109	0.00012			0.00619
NNE	0.00085	0.00364	0.00121	0.00024	0.00012		0.00607
NNW	0.00061	0.00376	0.00218	0.00049			0.00704
NW	0.00061	0.00340	0.00158	0.00049			0.00607
S	0.00267	0.00231	0.00049				0.00546
SE	0.00158	0.00243	0.00049				0.00449
SSE	0.00133	0.00243	0.00182	0.00024			0.00582
SSW	0.00158	0.00340	0.00097	0.00012			0.00607
SW	0.00109	0.00194	0.00097				0.00400
W	0.00133	0.00121	0.00061	0.00012			0.00328
WNW	0.00109	0.00255	0.00085				0.00449
WSW	0.00121	0.00194	0.00061	0.00012			0.00388
<b>Sum</b>	0.01978	0.04708	0.01747	0.00218	0.00024		0.08675

From 1/1/2006 To 12/31/2006

**Stability Class B**

**Wind Speed (Knots)**

Direction	0.6 - 3.0	4 - 6	7 - 10	11-16	17 - 21	> 21	Row Total
E	0.00024	0.00085	0.00073				0.00182
ENE	0.00024	0.00036	0.00073	0.00012			0.00146
ESE	0.00024	0.00024	0.00024				0.00073
N	0.00012	0.00085	0.00328	0.00097			0.00522
NE	0.00024	0.00049	0.00049	0.00036			0.00158
NNE	0.00012	0.00049	0.00146	0.00073			0.00279
NNW		0.00024	0.00218	0.00036			0.00279
NW	0.00012	0.00036	0.00073	0.00049	0.00012		0.00182
S	0.00109	0.00049	0.00170				0.00328
SE	0.00012	0.00036	0.00073	0.00012			0.00133
SSE	0.00061	0.00049	0.00061				0.00170
SSW	0.00109	0.00085	0.00049	0.00012			0.00255
SW	0.00012	0.00061	0.00049	0.00036			0.00158
W	0.00012	0.00073	0.00049	0.00012			0.00146
WNW		0.00097	0.00036	0.00024	0.00012		0.00170
WSW	0.00012	0.00036	0.00049				0.00097
<b>Sum</b>	<u>0.00461</u>	<u>0.00874</u>	<u>0.01517</u>	<u>0.00400</u>	<u>0.00024</u>		<u>0.03276</u>

From 1/1/2006 To 12/31/2006

**Stability Class C**

**Wind Speed (Knots)**

Direction	0.6 - 3.0	4 - 6	7 - 10	11-16	17 - 21	> 21	Row Total
E	0.00012	0.00085	0.00061	0.00012			0.00170
ENE		0.00061	0.00133	0.00024			0.00218
ESE	0.00012	0.00024	0.00073	0.00012			0.00121
N	0.00012	0.00085	0.00218	0.00267			0.00582
NE	0.00012	0.00061	0.00061	0.00097			0.00231
NNE		0.00024	0.00085	0.00206			0.00315
NNW		0.00024	0.00352	0.00413	0.00012		0.00801
NW		0.00085	0.00133	0.00218			0.00437
S	0.00158	0.00218	0.00170	0.00158			0.00704
SE	0.00024	0.00121	0.00085	0.00061	0.00012		0.00303
SSE	0.00061	0.00146	0.00146	0.00291	0.00012		0.00655
SSW	0.00097	0.00133	0.00182	0.00121	0.00049		0.00582
SW	0.00024	0.00085	0.00085	0.00073	0.00036		0.00303
W	0.00024	0.00036	0.00061		0.00012	0.00012	0.00146
WNW		0.00024	0.00231	0.00085			0.00340
WSW		0.00049	0.00109	0.00012	0.00024	0.00012	0.00206
<b>Sum</b>	<u>0.00437</u>	<u>0.01262</u>	<u>0.02184</u>	<u>0.02050</u>	<u>0.00158</u>	<u>0.00024</u>	<u>0.06115</u>

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From 1/1/2006 To 12/31/2006

**Stability Class D**

**Wind Speed (Knots)**

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<b>Direction</b>	<b>0.6 - 3.0</b>	<b>4 - 6</b>	<b>7 - 10</b>	<b>11-16</b>	<b>17 - 21</b>	<b>&gt; 21</b>	<b>Row Total</b>
E	0.00049	0.00267	0.00279	0.00049	0.00024		0.00667
ENE	0.00024	0.00255	0.00315	0.00255	0.00024		0.00874
ESE	0.00036	0.00121	0.00267	0.00170	0.00036		0.00631
N	0.00036	0.00255	0.00740	0.00825	0.00291	0.00049	0.02196
NE	0.00024	0.00279	0.00534	0.00473	0.00024	0.00012	0.01347
NNE	0.00024	0.00243	0.00777	0.00546	0.00121	0.00024	0.01735
NNW	0.00036	0.00255	0.01140	0.03264	0.01784	0.00582	0.07061
NW	0.00012	0.00388	0.00789	0.03531	0.01771	0.01189	0.07680
S	0.00437	0.01238	0.01322	0.02160	0.00364	0.00036	0.05557
SE	0.00036	0.00182	0.00400	0.00704	0.00231	0.00012	0.01565
SSE	0.00182	0.00522	0.00934	0.03397	0.01480	0.00303	0.06819
SSW	0.00497	0.01893	0.01383	0.01686	0.00352	0.00073	0.05884
SW	0.00073	0.00837	0.01092	0.01941	0.01213	0.00497	0.05654
W	0.00012	0.00619	0.00764	0.00255	0.00073		0.01723
WNW	0.00036	0.00328	0.01007	0.01407	0.00206	0.00097	0.03082
WSW	0.00097	0.00497	0.00425	0.00267	0.00146	0.00024	0.01456
<b>Sum</b>	<u>0.01614</u>	<u>0.08178</u>	<u>0.12169</u>	<u>0.20929</u>	<u>0.08141</u>	<u>0.02900</u>	<u>0.53931</u>

From 1/1/2006 To 12/31/2006

**Stability Class E**

**Wind Speed (Knots)**

Direction	0.6 - 3.0	4 - 6	7 - 10	11-16	17 - 21	> 21	Row Total
E	0.00049	0.00158	0.00182				0.00388
ENE	0.00036	0.00352	0.00279				0.00667
ESE	0.00036	0.00109	0.00206				0.00352
N	0.00024	0.00194	0.00279				0.00497
NE	0.00024	0.00352	0.00546				0.00922
NNE		0.00243	0.00558				0.00801
NNW	0.00073	0.00364	0.01068				0.01504
NW	0.00024	0.00534	0.01165				0.01723
S	0.00206	0.01796	0.02487				0.04489
SE	0.00049	0.00194	0.00534				0.00777
SSE	0.00073	0.00582	0.01092				0.01747
SSW	0.00473	0.03118	0.02135				0.05727
SW	0.00218	0.00340	0.00619				0.01177
W	0.00097	0.00303	0.00364				0.00764
WNW	0.00012	0.00291	0.00946				0.01250
WSW	0.00073	0.00097	0.00194				0.00364
<b>Sum</b>	<u>0.01468</u>	<u>0.09027</u>	<u>0.12655</u>				<u>0.23150</u>

---

From 1/1/2006 To 12/31/2006

**Stability Class F**

**Wind Speed (Knots)**

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Direction	0.6 - 3.0	4 - 6	7 - 10	11-16	17 - 21	> 21	Row Total
E	0.00049	0.00085					0.00133
ENE	0.00061	0.00158					0.00218
ESE	0.00133	0.00133					0.00267
N	0.00085	0.00085					0.00170
NE	0.00073	0.00085					0.00158
NNE	0.00146	0.00049					0.00194
NNW	0.00121	0.00049					0.00170
NW	0.00097	0.00182					0.00279
S	0.00206	0.00255					0.00461
SE	0.00121	0.00121					0.00243
SSE	0.00267	0.00085					0.00352
SSW	0.00510	0.00255					0.00764
SW	0.00425	0.00194					0.00619
W	0.00182	0.00097					0.00279
WNW	0.00121	0.00146					0.00267
WSW	0.00146	0.00133					0.00279
<b>Sum</b>	<u>0.02742</u>	<u>0.02111</u>	<u>          </u>	<u>          </u>	<u>          </u>	<u>          </u>	<u>0.04853</u>

## **Appendix C**

### Quality Assurance Audits

### TEOM Audit/Calibration

Network:	Buckskin
Date:	11/17/2006
Sampler ID: (SN# 22914)	N-TEOM
Current Software Version:	3.912
QA/Service by:	S.Engel / S.Mendenhall
Time instrument off line:	1301 MST
Notes on instrument as found:	

Parameter	Initial Values	
Filter Loading	48%	
Fadj Main	0.993	
Fadj Aux	1.016	
Case Temp	50.00	
Air Temp	50.00	
Cap Temp	50.00	
RS232 Mode	AU	
T - A/S	99.00	25.00
P - A/S	9.000	1.000
Storage Interval	3600	
Station ID	48048052	
Storage Var 1 & 2	01-STD MC	01-Hr MC
Storage Var 3 & 4	24-STD MC	24-Hr MC
Storage Var 5 & 6	Main Flow	Aux Flow
Storage Var 7 & 8	Status	Pres Drop

#### Standards

Manometer:	IML 0949
Temperature Standard:	IML 0915
Barometric Pressure Standard:	IML 0904
High flow FTS serial #:	010721
Low flow FTS serial #:	021099

FTS eqn: 
$$Q_a = m \times \left( \sqrt{\frac{(\Delta P \cdot T_a)}{P_a}} \right) + b$$

Q<sub>a</sub>: l/min      T<sub>a</sub>: Kelvin  
 DP: " H<sub>2</sub>O      P<sub>a</sub>: atmospheres

where:      m (high flow) = 0.3933  
               b (high flow) = -0.4415

              m (low flow) = 0.1082  
               b (low flow) = -0.2634

#### Audit

Sensor	Indicated	DP	Actual	Difference	Specification
Temperature	10.9		12.2	<b>1.3</b>	± 2.0 °C
Pressure	0.851	<b>25.68</b>	0.858	<b>0.007</b>	± 0.020 atm
Total Flow	16.63	5.70	16.68	<b>0.05</b>	± 1 l/min (for 16.7 l/min)
Main Flow	2.99	2.71	2.98	<b>0.01</b>	± 0.12 l/min (for 3.0 l/min)

#### Leak Checks

Flow	Value	Pass/Fail	Notes
Main	0.18	Fail	138% filter loading
Auxiliary	-0.02	Pass	

#### Service

<b>Inlet Serviced/Cleaned:</b>	Yes	<b>In-line filter(s) replaced:</b>	Main Flow
<b>Pump rebuilt:</b>	NO	<b>Flow controller orifices replaced:</b>	N/A
<b>Sensor filter replaced:</b>	Yes	<b>Flow controller filters replaced:</b>	N/A
<b>Other service:</b> Pump check passed			
Checked connections for main flow leak; nothing unusual found; will calibrate 1Q07			

**Post Service Leak Checks**

Flow	Value	Pass/Fail	Notes
Main	0.20	Fail	134% Filter Loading
Auxiliary	0.02	Pass	

**Post Service Operational Checks**

Sensor	Indicated	DP	Actual	Difference	Specification
Temperature	12.8		13.7	<b>0.9</b>	± 2.0 °C
Pressure	0.854	<b>25.68</b>	0.858	<b>0.004</b>	± 0.020 atm
Total Flow	16.64	5.50	16.64	<b>0.00</b>	± 1 l/min (for 16.7 l/min)
Main Flow	2.99	3.87	2.97	<b>0.02</b>	± 0.12 l/min (for 3.0 l/min)

**Calibration**

Sensor	Hardware Adjusted?	Final Indicated	Final Actual	Calibration FTS(s)	
Temperature				High Flow	m=
Pressure					b=
Fadj Main				Low Flow	m=
Fadj Aux					b=

**Mass Transducer Calibration Verification**

Actual K <sub>0</sub>	Filter Mass	Audit K <sub>0</sub>	% Difference	Specification	Notes
				< 2.5%	

Time instrument returned on line:	1328 MST	Parameter		Final Values	
Notes, comments:		Filter Loading	18%		
		Fadj Main	0.993		
		Fadj Aux	1.016		
		Case Temp	50.00		
		Air Temp	50.24 dropping		
		Cap Temp	50.00		
		RS232 Mode	AU		
		T - A/S	99.00	25.00	
		P - A/S	9.000	1.000	
		Storage Interval	3600		
		Station ID	48048052		
		Storage Var 1 & 2	01-STD MC	01-Hr MC	
		Storage Var 3 & 4	24-STD MC	24-Hr MC	
		Storage Var 5 & 6	Main Flow	Aux Flow	
		Storage Var 7 & 8	Status	Pres Drop	

### TEOM Audit/Calibration

Network:	Buckskin
Date:	11/17/2006
Sampler ID: (SN# 23159)	W-TEOM
Current Software Version:	3.912
QA/Service by:	S.Engel / S.Mendenhall
Time instrument off line:	1336 MST
Notes on instrument as found:	Had to restart Control unit
Cal Constant:	13143
Serial No.:	23159

Parameter	Initial Values	
Filter Loading	52%	
Fadj Main	0.966	
Fadj Aux	1.025	
Case Temp	50.00	
Air Temp	50.01	
Cap Temp	50.00	
RS232 Mode	AU	
T - A/S	99.00	25.00
P - A/S	9.000	1.000
Storage Interval	3600	
Station ID	48048051	
Storage Var 1 & 2	01-STD MC	01-Hr MC
Storage Var 3 & 4	24-STD MC	24-Hr MC
Storage Var 5 & 6	Main Flow	Aux Flow
Storage Var 7 & 8	Status	Pres Drop

#### Standards

Manometer:	IML 0949
Temperature Standard:	IML 0915
Barometric Pressure Standard:	IML 0904
High flow FTS serial #:	010721
Low flow FTS serial #:	021099

FTS eqn: 
$$Q_a = m \times \left( \sqrt{\frac{(\Delta P \cdot T_a)}{P_a}} \right) + b$$

Qa: l/min      Ta: Kelvin  
 DP: " H<sub>2</sub>O      Pa: atmospheres

where:      m (high flow) = 0.3933  
               b (high flow) = -0.4415

              m (low flow) = 0.1082  
               b (low flow) = -0.2634

#### Audit

Sensor	Indicated	DP	Actual	Difference	Specification
Temperature	9.0		9.2	<b>0.2</b>	± 2.0 °C
Pressure	0.856	<b>25.64</b>	0.856	<b>0.000</b>	± 0.020 atm
Total Flow	16.61	5.97	17.00	<b>0.39</b>	± 1 l/min (for 16.7 l/min)
Main Flow	3.00	2.80	3.02	<b>0.02</b>	± 0.12 l/min (for 3.0 l/min)

#### Leak Checks

Flow	Value	Pass/Fail	Notes
Main	0.05	Pass	177% filter loading
Auxiliary	-0.07	Pass	

#### Service

<b>Inlet Serviced/Cleaned:</b>	Yes	<b>In-line filter(s) replaced:</b>	No
<b>Pump rebuilt:</b>	NO	<b>Flow controller orifices replaced:</b>	N/A
<b>Sensor filter replaced:</b>	NO	<b>Flow controller filters replaced:</b>	N/A
<b>Other service:</b> Pump check passed			

**Post Service Leak Checks**

Flow	Value	Pass/Fail	Notes
Main			
Auxiliary			

**Post Service Operational Checks**

Sensor	Indicated	DP	Actual	Difference	Specification
Temperature					± 2.0 °C
Pressure					± 0.020 atm
Total Flow					± 1 l/min (for 16.7 l/min)
Main Flow					± 0.12 l/min (for 3.0 l/min)

**Calibration**

Sensor	Hardware Adjusted?	Final Indicated	Final Actual	Calibration FTS(s)
Temperature				
Pressure				
Fadj Main				
Fadj Aux				

**Mass Transducer Calibration Verification**

Actual K <sub>0</sub>	Filter Mass	Audit K <sub>0</sub>	% Difference	Specification	Notes
				< 2.5%	

Time instrument returned on line:	1358 MST	Parameter	Final Values	
Notes, comments: Reset Clock on control unit		Filter Loading	52%	
		Fadj Main	0.966	
		Fadj Aux	1.025	
		Case Temp	50.00	
		Air Temp	50.26 dropping	
		Cap Temp	49.99	
		RS232 Mode	AU	
		T - A/S	99.00	25.00
		P - A/S	9.000	1.000
		Storage Interval	3600	
		Station ID	48048051	
		Storage Var 1 & 2	01-STD MC	01-Hr MC
		Storage Var 3 & 4	24-STD MC	24-Hr MC
		Storage Var 5 & 6	Main Flow	Aux Flow
		Storage Var 7 & 8	Status	Pres Drop

## **Appendix D**

### Transfer Standard Certifications

# Certificate of Calibration

Streamline™ flow transfer standard (FTS) # 010721  
 was calibrated against NIST traceable critical flow  
 venturis sn10961, sn10962, sn10963 on: 2/15/2006

This calibration expires: **2/15/2007**

**r8**

The actual flow rate ( $Q_a$ ) through the FTS is:

$$Q_a = \left[ m \times \sqrt{\frac{(\Delta P)(T_{amb})}{(P_{amb})}} \right] + b$$

$$m = 0.3933$$

$$b = -0.4415$$

$Q_a$  = actual flow rate in liters/minute

$\Delta P$  = pressure reading from the manometer in "H<sub>2</sub>O

$T_{amb}$  = ambient temperature in Kelvins

$P_{amb}$  = ambient pressure in atmospheres\*

\* 1 atmosphere = 760 mmHg, = 29.92"Hg, =101,325 Pa

Reviewed: RLS

Date: 2/15/2006

## Quality Assurance Check

Primary Standard $Q_{actual}$ (l/min)	Streamline FTS $\Delta P$ ("H <sub>2</sub> O)	Streamline FTS $Q_{line\ fit}$ (l/min)	Absolute Difference (l/min)	% Difference* full scale
20.01	7.97	20.03	0.02	0.12%
17.49	6.11	17.49	0.00	-0.01%
14.98	4.51	14.97	-0.01	-0.04%
12.47	3.17	12.47	0.01	0.03%
9.97	2.04	9.92	-0.06	-0.28%
7.47	1.19	7.46	-0.01	-0.05%
4.99	0.57	5.03	0.05	0.23%
$T_a$ (°C) = 22.1 $P_a$ (atm) = 0.868 $r = 1.0000$				
*all points must be within $\pm 2\%$				

## Chinook Engineering

A Division of Inter-Mountain Laboratories, Inc.

555 Absaraka Street

Sheridan, Wyoming 82801 USA

(307) 672-7790

[chinook@imlinc.com](mailto:chinook@imlinc.com)

**Streamline™ FTS, US Patent #5792966**

# Certificate of Calibration

Streamline™ flow transfer standard (FTS) # 021099  
 was calibrated against NIST traceable critical flow  
 venturis sn10961, sn10962, sn10963 on: 2/13/2006

This calibration expires: **2/13/2007**

**r4**

The actual flow rate ( $Q_a$ ) through the FTS is:

$$Q_a = \left[ m \times \sqrt{\frac{(\Delta P)(T_{amb})}{(P_{amb})}} \right] + b$$

$$m = 0.1082$$

$$b = -0.2634$$

$Q_a$  = actual flow rate in liters/minute

$\Delta P$  = pressure reading from the manometer in "H<sub>2</sub>O

$T_{amb}$  = ambient temperature in Kelvins

$P_{amb}$  = ambient pressure in atmospheres\*

\* 1 atmosphere = 760 mmHg, = 29.92"Hg, =101,325 Pa

Reviewed: RLS

Date: 2/13/2006

## Quality Assurance Check

Primary Standard $Q_{actual}$ (l/min)	Streamline FTS $\Delta P$ ("H <sub>2</sub> O)	Streamline FTS $Q_{line\ fit}$ (l/min)	Absolute Difference (l/min)	% Difference* full scale
6.01	9.77	6.00	-0.01	-0.17%
5.08	7.08	5.06	-0.01	-0.21%
4.15	4.86	4.15	0.00	-0.02%
3.23	3.08	3.25	0.02	0.29%
2.31	1.69	2.34	0.03	0.44%
1.40	0.71	1.42	0.02	0.35%
0.49	0.13	0.45	-0.04	-0.67%
$T_a$ (°C) = 22.2 $P_a$ (atm) = 0.862 $r = 0.9999$				
*all points must be within $\pm 2\%$				

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555 Absaraka Street

Sheridan, Wyoming 82801 USA

(307) 672-7790

[chinook@imlinc.com](mailto:chinook@imlinc.com)

Streamline™ FTS, US Patent #5792966