Appendix A
Maintenance and Calibration

Air Resource Specialists, Inc.

Table 1-1
Calibration Summary

Network: NPS	Location: Yellowstone	Site: YELL
Date: 12/09/03	Last Site Visit:	Field Specialist: Faust, John

Parameter		Criteria	Accuracy Goal	Calibration Results					
				Pre-Maintenance			Post Maintenance		
				Mfg, Model # & Serial #	Value	Pass/Fail	Mfg, Model # & Serial #	Value	Pass/Fail
CO Analyzer - 146C	*Average Difference*	average error	<= ± 5.0%	TECO	0.8%	PASS	TECO		
	Maximum Difference	max error	<= ± 5.0%		2.2%	PASS			
	Correlation	actual	r > 0.9950		0.9999	PASS			
	Intercept	actual	<= ± 3.0 ppb		0.0	PASS			
	Slope	actual	0.950 <= m <= 1.050		0.998	PASS			
Mass Flow Correlation	*Low Cell (Dilution Air)*	correlation coefficient	r >= 0.9995	TECO 146C-71848-369	N/A	N/A	TECO 146C-71848-369	1.0000	PASS
	High Cell (Gas)	correlation coefficient	r >= 0.9995		N/A	N/A		1.0000	PASS
Barometric Pressure		max error	<= ± 1.5 mmhg						
CASTnet Flow	*Flow Rate*	max error	<= ± 5.0%						
	Leak Check	max error	<= ± 0.03						
Precipitation		max error	<= ± 5.0%						
Relative Humidity		max error	<= ± 5.0%	Rotronics ATRH MP101A-C4	4.0%	PASS	Rotronics ATRH MP101A-C4		
Solar Radiation		average error	<= ± 5%						
Delta Temperature		max error	Climatronics <= ± 0.1º C; RM Young <= ± 0.2º C	Rotronics ATRH MP101A-C4 25703			Rotronics ATRH MP101A-C4 25703		
Temperature		max error	Climatronics <= ± 0.2º C; RM Young <= ± 0.5º C; Rotronics <= ± 1.0º C		0.3º	PASS			
Wetness	*Dry*	response	about 0 VDC dry about 1 VDC wet						
	Wet	response							
Wind Direction	*Alignment*	max error	<= ± 5º	RM Young AQ 05305 23557	3º	PASS	RM Young AQ 05305 23557		
	Linearity	max error	<= ± 3º		4º	FAIL			
	Starting Threshold	max error	Climatronics <= 6 g-cm; RM Young AQ <= 9 g-cm; RM Young MA <= 30 g-cm, RM Young RE <= 7 g-cm						
Wind Speed	*max Wind Speed <5*	max error	<= ± 0.2 m/s	RM Young AQ 05305 23557	0.004	PASS	RM Young AQ 05305 23557		
	max Wind Speed >= 5	max error	<= ± 5%						
	Starting Threshold	max error	Climatronics <= 0.2 g-cm; RM Young AQ <= 0.3 g-cm; RM Young MA <= 2.9 g-cm, RM Young RE <= 0.3 g-cm						

Air Resource Specialists, Inc.

Calibration Standards

Field Specialist: Faust, John
Operator: Brad Ross
Network: NPS
Location: Yellowstone
Site: YELL
Date: 12/9/2003
Last Site Visit:

Parameter	Device	Manufacturer	Model	S/N	Calibration Date
Voltage	DVM	Fluke	8060A	test	
	Voltage Source	Calib. Inc.	DVC-350A	test	
Ozone	Transfer Standard	TECO	49PS		
Gas Dilution	Mass flow	ERT	Gas Dil		
Barometric Pressure		AIRS		test	
Flow	Dry cal	BIOS	DC2		
Precipitation	PPT Calibrator	Novalynx	260-2595		
	Volume (ml):	936			
Relative Humidity	RH Sensor	Rotronics	MP601	test	
Solar Radiation	Thermopile	LiCor	Pyranometer		
	Multiplier	95.64			
Temperature					
Wind Direction	Torque Gauge	RM Young	18331		
	Linearity Jig	RM Young	18212		
	Compass	Brunton	5006LM		
Wind Speed	Torque Disk	RM Young	18310		
	Anemometer Drive	RM Young	18801		

Comments:

Air Resource Specialists, Inc.

GAS DILUTION CALIBRATOR CALIBRATION FORM

Network: NPS	Location: Yellowstone	Site: YELL	Date: 12/09/03	Date of Last Site Visit:
				Field Specialist: Faust, John

Flow Standard Reference: BIOS, DC2	Flow Standard Reference S/N: N/A	Calibration Date:

Mass Flow Device (Dilution Air)

Mfg: TECO	S/N: 146C-71848-369	Range: 0-10 liters
Calibration Gas: Air	This primary standard automatically corrects to standard flow.	

FLOW METER DATA

Calibration Point	Display (y)	Flow SCCPM (x)
1	1.498	1.455
2	1.998	1.945
3	3.001	2.95
4	3.497	3.444
5		
6		

Linear Regression		
Parameter	Air Flow Controller	Pass/Fail
Slope (m)	1.003597	N/A
Y Intercept (b)	0.041192	N/A
Correlation Coefficient (r)	0.999993	PASS

Display Volts = (Flow SCCPM * m) + b

Flow SCCPM = (Display Volts - b) / m

Mass Flow Device (Gas 1)

Mfg:	S/N:	Range: 0-100 CC
Calibration Gas: Air	This primary standard automatically corrects to standard flow.	

FLOW METER DATA

Calibration Point	Display (y)	Flow SCCPM (x)
1	9.18	9.148
2	11.77	11.75
3	5.23	5.145
4		
5		
6		

Linear Regression		
Parameter	Gas Flow Controller	Pass/Fail
Slope (m)	0.989872	N/A
Y Intercept (b)	0.133588	N/A
Correlation Coefficient (r)	0.999997	PASS

Display Volts = (Flow SCCPM * m) + b

Flow SCCPM = (Display Volts -b) / m

MFC/MFM Comments:	Initial cal of YELL OF 146C

Air Resource Specialists, Inc.

CARBON MONOXIDE ANALYZER CALIBRATION FORM

(146C Calculations)

Network: NPS	Location: Yellowstone	Site: YELL	Date: 12/09/03	Date of Last Site Visit:
				Field Specialist: Faust, John

EQUIPMENT IDENTIFICATION

	Transfer Standard	Analyzer	Station Reference
Mfg.		TECO	TECO
Model #		48C-76069-381	146C
Serial #		48C-76069-381	146C-71848-369

REFERENCE GAS

Tank S/N	CC7340
Calibration Date	12/4/2002
Pressure Tank / Del.	1650/20
Tank Conc. (ppm)	3060

FLOW METER DATA

	Dilution Air	Gas
Slope (m)	1.004	0.990
Y Intercept (b)	0.0	0.1
Correlation Coefficient (r)	1.0000	1.0000

STATION TUBING

		CALCULATED FLOW		FLOW METER		PRE-MAINTENANCE (CO Bkg. (zero) = 3.778, CO Coef. (span) = 1.268)					
Calibration Point	Conc. (ppm)	Dil. Air (cc/min)	Gas (cc/min)	Dil. Air Inst. Dis.	Gas Inst. Dis.	DVM (volts)	DAS (ppm)	Recorder (%)	Difference (ppm)	% Difference	Pass/ Fail
ZERO	0.000	1992.03187	-0.101	2000.000	0.000	0.000	-0.003				
1	18.182	1972.11155	11.788	1980.000	11.770	0.908	18.140		-0.042	-0.2%	PASS
2	13.943	1997.01195	9.141	2005.000	9.150	0.695	13.910		-0.033	-0.2%	PASS
3	7.969	1977.09163	5.162	1985.000	5.210	0.389	7.790		-0.179	-2.2%	PASS
4	5.995	2482.07171	4.687	2492.000	4.740	0.301	6.030		0.035	0.6%	PASS
5											
ZERO	0.000		-0.101		0.000						
						Average ABS % Difference:				0.8%	PASS
						Maximum ABS % Difference:				2.2%	PASS

STATION TUBING

		POST MAINTENANCE (CO Bkg. (zero) = , CO Coef. (span) =)					
Calibration Point	Conc. (ppm)	DVM (volts)	DAS (ppm)	Recorder (%)	Difference (ppm)	% Difference	Pass/ Fail
ZERO	0.000	0.000					
1	18.182						
2	13.943						
3	7.969						
4	5.995						
5							
ZERO	0.000	0.000					
		Average ABS % Difference:					
		Maximum ABS % Difference:					

RESULTS

Linear Regression				
	PRE		POST	
Parameter	Analyzer	Pass/Fail	Analyzer	Pass/Fail
Slope	0.998	PASS		
Y Intercept	0.0	PASS		
Correlation Coefficient	0.9999	PASS		

CALIBRATION TIME

From:		To:	

Air Resource Specialists, Inc.

TEMPERATURE, DELTA TEMPERATURE AND RELATIVE HUMIDITY CALIBRATION FORM

Network: NPS	Location: Yellowstone	Site: YELL	Date: 12/09/03	Date of Last Site Visit:
				Field Specialist: Faust, John

Reference Thermometer S/N: N/A		Calibration Date:
Relative Humidity Reference S/N: test		Calibration Date:

TEMPERATURE / DELTA TEMPERATURE

SENSOR IDENTIFICATION

	Pre-Maintenance	Post Maintenance
Mfg.	Rotronics ATRH	Rotronics ATRH
Model #	MP101A-C4	MP101A-C4
Serial #	25703	25703
Translator Serial #		

PRE-MAINTENANCE SENSOR RESPONSE

BATH TEMP (º C)	TEMPERATURE		Difference (º C)	Pass/Fail	Δ TEMPERATURE		Difference (º C)	Pass/Fail
	DVM (volts)	DAS (º C)			DVM (volts)	DAS (º C)		
-5.4		-5.7	-0.3	PASS				
	Maximum Difference:		0.3	PASS	Maximum Difference:			

PRE- TRANSLATOR CARD RESPONSE

SETTING	TEMPERATURE		Δ TEMPERATURE	
	DVM (volts)	DAS (º C)	DVM (volts)	DAS (º C)
Zero				
Span				

POST MAINTENANCE SENSOR RESPONSE

BATH TEMP (º C)	TEMPERATURE		Difference (º C)	Pass/Fail	Δ TEMPERATURE		Difference (º C)	Pass/Fail
	DVM (volts)	DAS (º C)			DVM (volts)	DAS (º C)		
	Maximum Difference:				Maximum Difference:			

POST TRANSLATOR CARD RESPONSE

SETTING	TEMPERATURE		Δ TEMPERATURE	
	DVM (volts)	DAS (º C)	DVM (volts)	DAS (º C)
Zero				
Span				

Pre-Maint Temperature Comments:	
Post Maint Temperature Comments:	

RELATIVE HUMIDITY

SENSOR IDENTIFICATION

	Pre-Maintenance	Post Maintenance
Mfg.	Rotronics ATRH	Rotronics ATRH
Model #	MP101A-C4	MP101A-C4
Serial #		

PRE-MAINTENANCE SENSOR RESPONSE

HOUR	DAS	T.STD	Difference	Pass/Fail
10:00	72.0	68.0	4.0%	PASS

POST MAINTENANCE SENSOR RESPONSE

HOUR	DAS	T.STD	Difference	Pass/Fail
10:00				

Air Resource Specialists, Inc.

WIND DIRECTION CALIBRATION FORM

Network: NPS	Location: Yellowstone	Site: YELL	Date: 12/09/03	Date of Last Site Visit:
				Field Specialist: Faust, John

To Landmark #1:	304 Degrees True	From Landmark #1:	124	LM Description:	Boiler Stack
To Landmark #2:	237 Degrees True	From Landmark #2:	57	LM Description:	Camera
Declination:	Degrees				
Wind Direction Reference S/N: N/A				Calibration Date:	

WIND DIRECTION

SENSOR IDENTIFICATION

	PRE-MAINTENANCE	POST MAINTENANCE
Mfg.	RM Young AQ	RM Young AQ
Model #	05305	05305
Serial #	23557	23557
Translator Serial #		

WIND DIRECTION TRANSLATOR CARD

Card Setting	PRE		POST	
	DVM (volts)	DAS (m/s)	DVM (volts)	DAS (m/s)
Zero				
Span				
360				
Oscillator Frequency (Hz) =			Data Logger Should Read	

WIND DIRECTION STARTING THRESHOLD

PRE		POST	
Torque gm-cm	Pass/Fail	Torque gm-cm	Pass/Fail

Wind direction starting threshold accuracy goal:
RM Young AQ <= 9 g-cm

WIND DIRECTION ALIGNMENT

Land Mark Reference	PRE-MAINTENANCE				POST MAINTENANCE			
	DVM (volts)	DAS (degrees)	Degrees Difference	Pass/Fail	DVM (volts)	DAS (degrees)	Degrees Difference	Pass/Fail
To 1		303	-1	PASS				
From 1		122	-2	PASS				
To 2		236	-1	PASS				
From 2		54	-3	PASS				
	Average Difference:		2	PASS	Average Difference:			
	Maximum Difference:		3	PASS	Maximum Difference:			

WIND DIRECTION LINEARITY

Check Point	PRE-MAINTENANCE				POST MAINTENANCE			
	DVM (volts)	DAS (degrees)	Degrees Difference	Pass/Fail	DVM (volts)	DAS (degrees)	Degrees Difference	Pass/Fail
1		357	3	PASS				
2		38	-4	FAIL				
3		83	0	PASS				
4		127	-1	PASS				
5		173	1	PASS				
6		219	1	PASS				
7		264	0	PASS				
8		309	0	PASS				
	Average Difference:		1	PASS	Average Difference:			
	Maximum Difference:		4	FAIL	Maximum Difference:			

Pre-Maint Wind Direction Comments:	
Post Maint Wind Direction Comments:	

Air Resource Specialists, Inc.

WIND SPEED CALIBRATION FORM

Network: NPS	Location: Yellowstone	Site: YELL	Date: 12/09/03	Date of Last Site Visit:
				Field Specialist: Faust, John

Wind Speed Reference S/N: N/A		Calibration Date:

WIND SPEED

SENSOR IDENTIFICATION

	PRE-MAINTENANCE	POST MAINTENANCE
Mfg.	RM Young AQ	RM Young AQ
Model #	05305	05305
Serial #	23557	23557
Translator Serial #		

WIND SPEED TRANSLATOR CARD

Card Setting	PRE		POST	
	DVM (volts)	DAS (m/s)	DVM (volts)	DAS (m/s)
Zero				
Span				
Oscillator Frequency (Hz) =			Data Logger Should Read	

WIND SPEED STARTING THRESHOLD

PRE		POST	
Torque gm-cm	Pass/Fail	Torque gm-cm	Pass/Fail

Wind speed starting threshold accuracy goal:
RM Young AQ <= 0.3 g-cm

Motor Speed (rpm)			WIND SPEED PRE-MAINTENANCE					WIND SPEED POST MAINTENANCE				
	Climatronics (m/s)	RM Young (m/s)	DVM (volts)	DAS (m/s)	Difference (m/s)	% Difference	Pass/Fail	DVM (volts)	DAS (m/s)	Difference (m/s)	% Difference	Pass/Fail
100	2.574	0.510										
300	7.274	1.540		1.536	-0.004		PASS					
600	14.324	3.070										
900	21.375	4.610		4.608	-0.002		PASS					
1200	28.425	6.140										
1800	42.526	9.220		9.216	-0.004	0.0%	PASS					
4000	N/A	20.480		20.480	0.000	0.0%	PASS					
7000	N/A	35.840		35.840	0.000	0.0%	PASS					
Maximum ABS Difference (use if Wind Speed <5):					0.004		PASS					
Maximum ABS % Difference (use if Wind Speed >=5):												

Pre-Maint Wind Speed Comments:	
Post Maint Wind Speed Comments:	

Air Resource Specialists, Inc.

Table 1-1
Calibration Summary

Network:	Location: Near Warming Hut	Site: YELL-OF
Date: 02/19/04	Last Site Visit: 12/21/03	Field Specialist: Faust, John

Parameter		Criteria	Accuracy Goal	Calibration Results					
				Pre-Maintenance			Post Maintenance		
				Mfg, Model # & Serial #	Value	Pass/Fail	Mfg, Model # & Serial #	Value	Pass/Fail
CO Analyzer - 146C	*Average Difference*	average error	<= ± 5.0%		19.9%	FAIL		0.9%	PASS
	Maximum Difference	max error	<= ± 5.0%		25.3%	FAIL		2.4%	PASS
	Correlation	actual	r > 0.9950		0.9977	PASS		0.9999	PASS
	Intercept	actual	<= ± 3.0 ppb		0.6	PASS		0.0	PASS
	Slope	actual	0.950 <= m <= 1.050		1.120	FAIL		1.003	PASS
Mass Flow Correlation	*Low Cell (Dilution Air)*	correlation coefficient	r >= 0.9995	TECO 146C-71848-369	N/A	N/A	TECO 146C-71848-369	1.0000	PASS
	High Cell (Gas)	correlation coefficient	r >= 0.9995		N/A	N/A		0.9999	PASS
Barometric Pressure		max error	<= ± 1.5 mmhg						
CASTnet Flow	*Flow Rate*	max error	<= ± 5.0%						
	Leak Check	max error	<= ± 0.03						
Precipitation		max error	<= ± 5.0%						
Relative Humidity		max error	<= ± 5.0%	Rotronics ATRH MP101A-C4	0.7%	PASS	Rotronics ATRH MP101A-C4		
Solar Radiation		average error	<= ± 5%						
Delta Temperature		max error	Climatronics <= ± 0.1º C; RM Young <= ± 0.2º C	Rotronics ATRH MP101A-C4 25703			Rotronics ATRH MP101A-C4 25703		
Temperature		max error	Climatronics <= ± 0.2º C; RM Young <= ± 0.5º C; Rotronics <= ± 1.0º C		0.0º	PASS			
Wetness	*Dry*	response	about 0 VDC dry about 1 VDC wet						
	Wet	response							
Wind Direction	*Alignment*	max error	<= ± 5º	RM Young AQ 05305 23557			RM Young AQ 05305 23557		
	Linearity	max error	<= ± 3º						
	Starting Threshold	max error	Climatronics <= 6 g-cm; RM Young AQ <= 9 g-cm; RM Young MA <= 30 g-cm, RM Young RE <= 7 g-cm						
Wind Speed	*max Wind Speed <5*	max error	<= ± 0.2 m/s	RM Young AQ 05305 23557			RM Young AQ 05305 23557		
	max Wind Speed >= 5	max error	<= ± 5%						
	Starting Threshold	max error	Climatronics <= 0.2 g-cm; RM Young AQ <= 0.3 g-cm; RM Young MA <= 2.9 g-cm, RM Young RE <= 0.3 g-cm						

Air Resource Specialists, Inc.

Calibration Standards

Field Specialist: Faust, John
Operator: Gary Nelson
Network:
Location: Near Warming Hut
Site: YELL-OF
Date: 2/19/2004
Last Site Visit: 12/21/2003

Parameter	Device	Manufacturer	Model	S/N	Calibration Date
Voltage	DVM	Fluke	8060A	test	
	Voltage Source	Calib. Inc.	DVC-350A	test	
Ozone	Transfer Standard	TECO	49PS		
Gas Dilution	Mass flow	ERT	Gas Dil		
Barometric Pressure		AIRS		test	
Flow	Dry cal	BIOS DC2	L 1646	H 2185	01/05/04
Precipitation	PPT Calibrator	Novalynx	260-2595		
	Volume (ml):	936			
Relative Humidity	RH Sensor	Rotronics	MP601	test	
Solar Radiation	Thermopile	LiCor	Pyranometer		
	Multiplier	95.64			
Temperature					
Wind Direction	Torque Gauge	RM Young	18331		
	Linearity Jig	RM Young	18212		
	Compass	Brunton	5006LM		
Wind Speed	Torque Disk	RM Young	18310		
	Anemometer Drive	RM Young	18801		

Comments:

Air Resource Specialists, Inc.

GAS DILUTION CALIBRATOR CALIBRATION FORM

Network:	Location: Near Warming Hut	Site: YELL-OF	Date: 02/19/04	Date of Last Site Visit: 12/21/03
				Field Specialist: Faust, John

Flow Standard Reference: BIOS DC2, L 1646	Flow Standard Reference S/N: H 2185	Calibration Date: 01/05/04

Mass Flow Device (Dilution Air)

Mfg: TECO	S/N: 146C-71848-369	Range: 0-10 liters
Calibration Gas: Air	This primary standard automatically corrects to standard flow.	

FLOW METER DATA

Calibration Point	Display (y)	Flow SCCPM (x)
1	0.498	0.4918
2	1.497	1.485
3	2.501	2.484
4	3.498	3.471
5	4.499	4.466
6	5.501	5.455

Linear Regression		
Parameter	Air Flow Controller	Pass/Fail
Slope (m)	1.007827	N/A
Y Intercept (b)	0.000245	N/A
Correlation Coefficient (r)	0.999999	PASS

Display Volts = (Flow SCCPM * m) + b

Flow SCCPM = (Display Volts - b) / m

Mass Flow Device (Gas 1)

Mfg:	S/N:	Range: 0-100 CC
Calibration Gas: Air	This primary standard automatically corrects to standard flow.	

FLOW METER DATA

Calibration Point	Display (y)	Flow SCCPM (x)
1	3.96	3.931
2	7.99	8.056
3	14.96	15.05
4	25	24.66
5	34.98	35.07
6	45	45.12

Linear Regression		
Parameter	Gas Flow Controller	Pass/Fail
Slope (m)	0.998420	N/A
Y Intercept (b)	0.035220	N/A
Correlation Coefficient (r)	0.999942	PASS

Display Volts = (Flow SCCPM * m) + b

Flow SCCPM = (Display Volts -b) / m

MFC/MFM Comments:	Mid study calibration of 146C

Air Resource Specialists, Inc.

CARBON MONOXIDE ANALYZER CALIBRATION FORM

(146C Calculations)

Network:	Location: Near Warming Hut	Site: YELL-OF	Date: 02/19/04	Date of Last Site Visit: 12/21/03
				Field Specialist: Faust, John

EQUIPMENT IDENTIFICATION

	Transfer Standard	Analyzer	Station Reference
Mfg.			TECO
Model #			146C
Serial #		48C-76069-381	146C-71848-369

REFERENCE GAS

Tank S/N	CC7340
Calibration Date	12/4/2002
Pressure Tank / Del.	1650/20
Tank Conc. (ppm)	3060

FLOW METER DATA

	Dilution Air	Gas
Slope (m)	1.008	0.998
Y Intercept (b)	0.0	0.0
Correlation Coefficient (r)	1.0000	0.9999

STATION TUBING

		CALCULATED FLOW		FLOW METER		PRE-MAINTENANCE (CO Bkg. (zero) = 5.854, CO Coef. (span) = 1.268)					
Calibration Point	Conc. (ppm)	Dil. Air (cc/min)	Gas (cc/min)	Dil. Air Inst. Dis.	Gas Inst. Dis.	DVM (volts)	DAS (ppm)	Recorder (%)	Difference (ppm)	% Difference	Pass/ Fail
ZERO	0.000	1999.00794	0.000	2015.000	0.000		0.371				
1	18.013	3973.21429	23.527	4005.000	23.480	1.002	20.040		2.027	11.3%	FAIL
2	14.003	3982.14286	18.307	4014.000	18.270	0.857	17.130		3.127	22.3%	FAIL
3	7.994	3990.07937	10.451	4022.000	10.430	0.480	9.500		1.506	18.8%	FAIL
4	5.778	3992.06349	7.575	4024.000	7.560	0.355	7.030		1.252	21.7%	FAIL
5	4.000	4494.04762	5.882	4530.000	5.870	0.254	5.010		1.010	25.3%	FAIL
ZERO	0.000	1999.00794	0.000	2015.000	0.000		0.400		0.400		
						Average ABS % Difference:				19.9%	FAIL
						Maximum ABS % Difference:				25.3%	FAIL

STATION TUBING

		POST MAINTENANCE (CO Bkg. (zero) = 6.257, CO Coef. (span) = 1.122)					
Calibration Point	Conc. (ppm)	DVM (volts)	DAS (ppm)	Recorder (%)	Difference (ppm)	% Difference	Pass/ Fail
ZERO	0.000	0.069	0.070				
1	18.013	0.906	18.140		0.127	0.7%	PASS
2	14.003	0.701	14.020		0.017	0.1%	PASS
3	7.994	0.390	7.800		-0.194	-2.4%	PASS
4	5.778	0.288	5.781		0.003	0.1%	PASS
5	4.000	0.203	4.050		0.050	1.3%	PASS
ZERO	0.000	0.000	-0.001				
		Average ABS % Difference:				0.9%	PASS
		Maximum ABS % Difference:				2.4%	PASS

RESULTS

Linear Regression				
	PRE		POST	
Parameter	Analyzer	Pass/Fail	Analyzer	Pass/Fail
Slope	1.120	FAIL	1.003	PASS
Y Intercept	0.6	PASS	0.0	PASS
Correlation Coefficient	0.9977	PASS	0.9999	PASS

CALIBRATION TIME

From:		To:	

Air Resource Specialists, Inc.

TEMPERATURE, DELTA TEMPERATURE AND RELATIVE HUMIDITY CALIBRATION FORM

Network:	Location: Near Warming Hut	Site: YELL-OF	Date: 02/19/04	Date of Last Site Visit: 12/21/03
				Field Specialist: Faust, John

Reference Thermometer S/N: N/A		Calibration Date:
Relative Humidity Reference S/N: test		Calibration Date:

TEMPERATURE / DELTA TEMPERATURE

SENSOR IDENTIFICATION

	Pre-Maintenance	Post Maintenance
Mfg.	Rotronics ATRH	Rotronics ATRH
Model #	MP101A-C4	MP101A-C4
Serial #	25703	25703
Translator Serial #		

PRE-MAINTENANCE SENSOR RESPONSE

BATH TEMP (º C)	TEMPERATURE		Difference (º C)	Pass/Fail	Δ TEMPERATURE		Difference (º C)	Pass/Fail
	DVM (volts)	DAS (º C)			DVM (volts)	DAS (º C)		
-0.7		-0.7	0.0	PASS				
	Maximum Difference:		0.0	PASS	Maximum Difference:			

PRE- TRANSLATOR CARD RESPONSE

SETTING	TEMPERATURE		Δ TEMPERATURE	
	DVM (volts)	DAS (º C)	DVM (volts)	DAS (º C)
Zero				
Span				

POST MAINTENANCE SENSOR RESPONSE

BATH TEMP (º C)	TEMPERATURE		Difference (º C)	Pass/Fail	Δ TEMPERATURE		Difference (º C)	Pass/Fail
	DVM (volts)	DAS (º C)			DVM (volts)	DAS (º C)		
	Maximum Difference:				Maximum Difference:			

POST TRANSLATOR CARD RESPONSE

SETTING	TEMPERATURE		Δ TEMPERATURE	
	DVM (volts)	DAS (º C)	DVM (volts)	DAS (º C)
Zero				
Span				

Pre-Maint Temperature Comments:	Checked against Neph AT/RH sensor
Post Maint Temperature Comments:	

RELATIVE HUMIDITY

SENSOR IDENTIFICATION

	Pre-Maintenance	Post Maintenance
Mfg.	Rotronics ATRH	Rotronics ATRH
Model #	MP101A-C4	MP101A-C4
Serial #		

PRE-MAINTENANCE SENSOR RESPONSE

HOUR	DAS	T.STD	Difference	Pass/Fail
13:00	56.7	56.0	0.7%	PASS

POST MAINTENANCE SENSOR RESPONSE

HOUR	DAS	T.STD	Difference	Pass/Fail
10:00				

Air Resource Specialists, Inc.

WIND DIRECTION CALIBRATION FORM

Network:	Location: Near Warming Hut	Site: YELL-OF	Date: 02/19/04	Date of Last Site Visit: 12/21/03
				Field Specialist: Faust, John

To Landmark #1: 304 Degrees True	From Landmark #1: 124	LM Description:	Boiler Stack
To Landmark #2: 237 Degrees True	From Landmark #2: 57	LM Description:	Camera
Declination: Degrees			
Wind Direction Reference S/N: N/A		Calibration Date:	

WIND DIRECTION

SENSOR IDENTIFICATION

	PRE-MAINTENANCE	POST MAINTENANCE
Mfg.	RM Young AQ	RM Young AQ
Model #	05305	05305
Serial #	23557	23557
Translator Serial #		

WIND DIRECTION TRANSLATOR CARD

Card Setting	PRE		POST	
	DVM (volts)	DAS (m/s)	DVM (volts)	DAS (m/s)
Zero				
Span				
360				
Oscillator Frequency (Hz) =			Data Logger Should Read	

WIND DIRECTION STARTING THRESHOLD

PRE		POST	
Torque gm-cm	Pass/Fail	Torque gm-cm	Pass/Fail

Wind direction starting threshold accuracy goal:
RM Young AQ <= 9 g-cm

WIND DIRECTION ALIGNMENT

Land Mark Reference	PRE-MAINTENANCE				POST MAINTENANCE			
	DVM (volts)	DAS (degrees)	Degrees Difference	Pass/Fail	DVM (volts)	DAS (degrees)	Degrees Difference	Pass/Fail
To 1								
From 1								
To 2								
From 2								
	Average Difference:				Average Difference:			
	Maximum Difference:				Maximum Difference:			

WIND DIRECTION LINEARITY

Check Point	PRE-MAINTENANCE				POST MAINTENANCE			
	DVM (volts)	DAS (degrees)	Degrees Difference	Pass/Fail	DVM (volts)	DAS (degrees)	Degrees Difference	Pass/Fail
1								
2								
3								
4								
5								
6								
7								
8								
	Average Difference:				Average Difference:			
	Maximum Difference:				Maximum Difference:			

Pre-Maint Wind Direction Comments:	
Post Maint Wind Direction Comments:	

Air Resource Specialists, Inc.

WIND SPEED CALIBRATION FORM

Network:	Location: Near Warming Hut	Site: YELL-OF	Date: 02/19/04	Date of Last Site Visit: 12/21/03
				Field Specialist: Faust, John

Wind Speed Reference S/N: N/A		Calibration Date:

WIND SPEED

SENSOR IDENTIFICATION

	PRE-MAINTENANCE	POST MAINTENANCE
Mfg.	RM Young AQ	RM Young AQ
Model #	05305	05305
Serial #	23557	23557
Translator Serial #		

WIND SPEED TRANSLATOR CARD

Card Setting	PRE		POST	
	DVM (volts)	DAS (m/s)	DVM (volts)	DAS (m/s)
Zero				
Span				
Oscillator Frequency (Hz) =			Data Logger Should Read	

WIND SPEED STARTING THRESHOLD

PRE		POST	
Torque gm-cm	Pass/Fail	Torque gm-cm	Pass/Fail

Wind speed starting threshold accuracy goal:
RM Young AQ <= 0.3 g-cm

Motor Speed (rpm)			WIND SPEED PRE-MAINTENANCE					WIND SPEED POST MAINTENANCE				
	Climatronics (m/s)	RM Young (m/s)	DVM (volts)	DAS (m/s)	Difference (m/s)	% Difference	Pass/Fail	DVM (volts)	DAS (m/s)	Difference (m/s)	% Difference	Pass/Fail
100	2.574	0.510										
300	7.274	1.540										
600	14.324	3.070										
900	21.375	4.610										
1200	28.425	6.140										
1800	42.526	9.220										
4000	N/A	20.480										
7000	N/A	35.840										
Maximum ABS Difference (use if Wind Speed <5):												
Maximum ABS % Difference (use if Wind Speed >=5):												

Pre-Maint Wind Speed Comments:	
Post Maint Wind Speed Comments:	