



Site: Bishop Paiute Reservation

Audit Date: November 30, 2022

Instrumentation Audited: Meteorology and Particulate Matter

Key Person(s): Emma Ruppell

Auditor: David Yoho

Technical & Business Systems, Inc.
26368 Ruether Ave
Santa Clarita, CA 91350

The purpose of this summary is to provide a report of significant audit findings at the Bishop Paiute Reservation in Bishop, California. Key elements of the audit are identified below. Results of the performance audit comparisons are included.

GENERAL COMMENTS

No comments were noted at the time of the audit.

KEY AUDIT FINDINGS

Ozone

The ozone analyzer was not audited. The analyzer will be audited within the coming months.

Meteorology

- The audit of the precipitation gauge had results that do not meet the recommended criteria of $\pm 10\%$. Replacing the cracked signal cable is recommended in addition to recalibrating the gauge.
- While the barometric pressure audit results passed the recommended criteria, the factors were adjusted to bring the sensor response closer to the correct reading.

Particulate Matter (PM₁₀ and PM_{2.5})

No performance problems were noted.

AUDIT RECORD

HORIZONTAL WIND SPEED



26368 Rutherford Ave
Santa Clarita, CA 91350
(661) 309-6225

Date: **11/30/22**
Start: **8:30 PST**
Finish: **11:00 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

Site Name: **Bishop Paiute**
Operator: **Emma Ruppell**
Project: **QA**

Manufacturer: **RM Young**
Serial No.: **179042**
K factor: **3.8**
Range: **0 - 125 mph**
Last Calibrated: **NA**

Model: **05305**
Sensor Ht.: **10 meters**
Starting torque: **0.1 gm cm**
Starting threshold: **0.36 mph**
Starting threshold criteria: **1.1 mph**

Audit Point	Input MPH	DAS MPH	Diff. MPH
1	0.00	0.00	0.00
2	5.73	5.73	0.00

Audit Criteria: $\pm .56 MPH$; $ws \leq 11.2 MPH$

Audit Point	Input MPH	DAS MPH	Diff. %
3	17.18	17.18	0.0
4	28.63	28.63	0.0
5	40.08	40.08	0.0
6	51.53	51.53	0.0
7	62.98	62.98	0.0
8	74.43	74.43	0.0

Audit Criteria: $\pm 5\%$; $ws > 11.2 MPH$

Comments: No problems were noted.

AUDIT RECORD

HORIZONTAL WIND DIRECTION



26368 Rutherford Ave
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(661) 309-6225

Date: **11/30/22**
Start: **8:30 PST**
Finish: **11:00 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

Site Name: **Bishop Paiute**
Operator: **Emma Ruppell**
Project: **QA**

Manufacturer: **RM Young**

Model: **05305**

Serial No.: **179042**

Sensor Ht.: **10 meters**

K factor: **37**

Starting torque: **6** gm cm

Range: **0 - 360°**

Starting threshold: **0.90** mph

Crossarm: **180°**

Starting threshold criteria: **1.1** mph

Last Calibrated: **NA**

Audit Point	Degrees Reference	Degrees DAS	Diff. Degrees
1	45	45	0
2	90	87	-3
3	135	132	-3
4	180	179	-1
5	225	225	0
6	270	271	1
7	315	318	3
8	0	2	2

Audit Criteria: ± 5 degrees

Comments: No problems were noted.

AUDIT RECORD

AMBIENT TEMPERATURE



26368 Rutherford Ave
Santa Clarita, CA 91350
(661) 309-6225

Date: **11/30/22**
Start: **8:30 PST**
Finish: **11:00 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

Site Name: **Bishop Paiute**
Operator: **Emma Ruppell**
Project: **QA**

Manufacturer: **Climatronics**

Model: **62**

Serial No.: **6916**

Sensor Ht.: **9 m**

Lower Range: **-22** **Deg F**
Upper Range: **122** **Deg F**

Last Calibrated: **NA**

Audit Point	Input Deg F	DAS Deg F	Diff. Deg F
1	32.8	32.6	-0.2
2	71.3	71.0	-0.3
3	101.2	101.5	0.3

Audit Criteria: $\pm 1.8^{\circ}F$

Comments: No problems were noted.

AUDIT RECORD***PRECIPITATION***

26368 Rutherford Ave
Santa Clarita, CA 91350
(661) 309-6225

Date: **11/30/22**
Start: **8:30 PST**
Finish: **11:00 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

Site name: **Bishop Paiute**
Operator: **Emma Ruppell**
Project: **QA**

Manufacturer: **Climatronics**
Serial No.: **956**
Units: **inches**
Last Calibrated: **NA**

Model: **100508-G1**
Sensor Ht.: **1.5 m above roof**
Funnel Diam: **15.4 cm**

Audit Point	Input Inches	DAS Inches	Diff. %
1	1.06	0.73	-30.9

Audit Criteria: $\pm 10\%$ of input

Comments: The audit results for the tipping bucket did not meet the criteria. It is recommended to replace the signal cable and recalibrate the tipping bucket.

AUDIT RECORD

SOLAR RADIATION



26368 Rutherford Ave
Santa Clarita, CA 91350
(661) 309-6225

Date: **11/30/22**

Start: **8:30 PST**

Finish: **11:00 PST**

Auditor: **David Yoho**

Witness: **Emma Ruppell**

Site name: **Bishop Paiute**

Operator: **Emma Ruppell**

Project: **QA**

Sensor Mfg: **K&Z**

Serial No.: **113299**

Model: **SP-Lite**

Sensor Ht.: **8 meters**

Range: **0 - 2.145 Langleys/min**

Last Calibrated: **NA**

Audit Point	Input L/min	DAS L/min	% Diff
1	0.636	0.583	-8.3
2	0.699	0.638	-8.7
3	0.735	0.677	-7.9
4	0.800	0.746	-6.8

Criteria: ± 10%

Comments: No problems were noted.

AUDIT RECORD

BAROMETRIC PRESSURE

T&B Systems

26368 Rutherford Ave
Santa Clarita, CA 91350
(661) 309-6225

Date: **11/30/22**

Start: **8:30 PST**

Finish: **11:00 PST**

Auditor: **David Yoho**

Witness: **Emma Ruppell**

Site name: **Bishop Paiute**

Operator: **Emma Ruppell**

Project: **QA**

Manufacturer: **Climatronics**

Model: **1022761**

Serial No.: **87**

Sensor Ht.: **2 m**

Units: **mb**

Last Calibrated: **NA**

Audit Point	Input mb	DAS mb	Diff. mb
As found	870.8	873.4	2.6
As left	870.8	870.4	-0.4

Audit Criteria: ± 3.0 mb

Comments: While the pressure passed the audit, the factors were adjusted to bring the response closer to the true reading.

AUDIT RECORD

RELATIVE HUMIDITY



26368 Rutherford Ave
Santa Clarita, CA 91350
(661) 309-6225

Date: **11/30/22**

Start: **8:30 PST**

Finish: **11:00 PST**

Auditor: **David Yoho**

Witness: **Emma Ruppell**

Site name: **Bishop Paiute**

Operator: **Emma Ruppell**

Project: **QA**

Sensor Mfg: **Climatronics**

Serial No.: **NA**

Model: **NA**

Range: **0-100 %**

Sensor Ht.: **9 meters**

Last Calibrated: **NA**

Audit Point	Input RH (%)	DAS RH (%)	Diff. %
1	45.5	44.6	-0.9
2	44.0	41.6	-2.4
3	40.9	40.4	-0.5
4	38.1	40.9	2.8
5	36.1	39.5	3.4

Criteria: ± 10%

Comments: No problems were noted.

AUDIT RECORD**PM10**

26368 Rutherford Ave
Santa Clarita, CA 91350
(661) 309-6225

Date: **11/30/22**Start: **11:00 PST**Finish: **12:00 PST**Auditor: **David Yoho**Witness: **Emma Ruppell**Site name: **Bishop Paiute**Operator: **Emma Ruppell**Project: **QA**Sampler: **TEOM (PM10)**Serial No.: **1405A231661508**Make: **Thermo**Model: **1405**Last Calibrated.: **11/21/22**

Amb. Press: **25.68 in. Hg**
Amb. Temp.: **7.8 °C**

FlowmetersModel: **Alicat FP25**Certification Date: **5/26/2022**T Case (°C): **50.00**T Cap (°C): **50.00**T Air (°C): **50.00**F Main (lpm): **3.00**F Aux (lpm) **13.65**

	Audit	Site	Diff.
Main	3.04 lpm	3.00 lpm	-1.3%
Bypass	13.92 lpm	13.65 lpm	-1.9%
Total	16.96 lpm	16.65 lpm	-1.8%
Amb T	7.8 °C	7.9 °C	0.1
Amb P	0.858 atm	0.858 atm	0.000

Audit Criteria: *Flow - ± 10%; Total 15.00 - 18.34 lpm**Amb T - ± 2 °C**Amb P - ± 0.013 atm***Leak Check**

Main:	0.00 lpm	Audit Criteria:	<0.15 lpm
Bypass:	-0.18 lpm		<0.60 lpm

Mass Transducer Calibration Verification

Cal Filter Weight (g)	Frequency (w/o filter) (Hz)	Frequency (with filter) (Hz)	Audit K ₀	Actual K ₀	Error (%)
NA	NA	NA	NA	NA	NA

Audit Criteria: ± 2.5%

Comments: No problems were noted. A mass transducer calibration verification was not performed.

AUDIT RECORD**PM_{2.5}**

26368 Rutherford Ave
Santa Clarita, CA 91350
(661) 309-6225

Date: **11/30/22**
Start: **11:00 PST**
Finish: **12:00 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

Site name: **Bishop Paiute**
Operator: **Emma Ruppell**
Project: **QA**

Sampler: **Teledyne API**
Serial No.: **070600000**
Last Calibrated.: **11/10/22**

Model: **T640**

Amb. Press: **25.68 in. Hg**
Amb. Temp.: **8.6 °C**
Leak Check: **0.000 ug/m³**

Flowmeters
Model: **Alicat FP25**
Certification Date: **5/26/2022**

	Audit	Site	Diff.
Flowrate:	4.95 lpm	4.99 lpm	0.8%
Amb T (°C)	8.6 °C	8.6 °C	0.0
Amb P (mm Hg)	652.5 mm Hg	650.8 mm Hg	-1.7

Audit Criteria:
Flow - ±4%
Amb T - ±2 °C
Amb P - ±10 mm Hg

Comments: No problems were noted.



Site: Bishop Paiute Reservation

Audit Date: February 1, 2023

Instrumentation Audited: Ozone Analyzer

Key Person(s): Emma Ruppell

Auditor: David Yoho

Technical & Business Systems, Inc.
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Santa Clarita, CA 91350

The purpose of this summary is to provide a report of significant audit findings at the Bishop Paiute Reservation in Bishop, California. Key elements of the audit are identified below. Results of the performance audit comparisons are included.

GENERAL COMMENTS

No comments were noted at the time of the audit.

KEY AUDIT FINDINGS

Ozone

There were no issues noted at the time of the ozone analyzer audit.

AUDIT RECORD

OZONE



26368 Rutherford Ave
Santa Clarita, CA 91350
(661) 309-6225

Date: **02/01/23**
Start: **15:40 PST**
Finish: **16:40 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

Site Name: **Bishop Paiute**
Operator: **Emma Ruppell**
Project: **QA**

Analyzer make: **Thermo Electron**
Serial No.: **630719320**
Sample flow: **0.593/0.603 lpm**
Slope Set Point: **1.012**
Zero Set Point: **0.40**
Range: **0.5 ppm**
Model: **49i**
Filter: **01/18/23**
Ozone Measure: **90509**
Ozone Ref: **120750**
Last Calibrated: **01/25/23**

O ₃ Audit Point	PPM Input (X)	PPM DAS (Y)	PPM Dif (%)
1	0.000	-0.001	
2	0.015	0.016	6.7
3	0.034	0.034	0.0
4	0.083	0.082	-1.2
5	0.183	0.180	-1.6

Linear Regression: (Y=PPM Corrected, X=PPM Input)

Audit Statistics	
Slope:	0.983
Intercept:	0.000
Correlation:	0.9999

Comments: No problems were noted.

Audit Equipment	Make	Model	ID	Certification Date
Dilution System:	API	M700EU	83	1/31/23
Ozone Standard:	API	M700EU	83	11/07/22
Zero Air System:	API	701	2427	NA

Ozone Transfer Standard		
Sample Freq: NA	Cell Temperature:	NA deg C
Control Freq: NA	Ambient Pressure:	NA "Hg
Span Setting: NA	Certification Slope:	0.9923
	Certification Intercept:	0.0000 ppm