



25570 Rye Canyon Road Unit J • Valencia, California 91355 • (661)-294-1103 fax (661)-294-0236

Site: Bishop Paiute Reservation

Audit Date: September 12, 2019

Instrumentation Audited: Ozone, Meteorology and Particulate Matter

Key Person(s): Emma Ruppell

Auditor: David Yoho

Technical & Business Systems, Inc.
25570 Rye Canyon Rd., Unit J
Valencia, CA 91355

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

No performance problems were noted.

Meteorology

1. An audit of the tipping bucket rain gauge had results that do not meet the recommended criteria. The site operator was aware of the issue with the tipping bucket prior to the audit as the tipping bucket had been adjusted purposely higher to test against a manual rain gauge.
2. The wind direction sensor 360-degree point indicated 207 degrees on the DAS when the vane was completely still. When the wind vane was slightly rotated to the left and right of 360 degrees the DAS showed 360 degrees. It was recommended to the site operator to purchase a new sensor and return the current sensor to the Climatronics for refurbishing.

Particulate Matter

1. A leak was detected in the PM_{2.5} sampler's Bypass and Main flow channels. Diagnosing and repairing the leaks is recommended.

AUDIT RECORD



25570 Rye Cyn Rd., Unit J
Valencia, CA 91355
(661) 294-1103

OZONE

Date: **09/12/19**
Start: **8:40 PST**
Finish: **10:30 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

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

Analyzer make: **Thermo Electron** Model: **49i**
Serial No.: **630719320** Filter: **NA**
Sample flow: **0.603/0.553 lpm** Ozone Measure: **76699**
Slope Set Point: **1990.48** Ozone Ref: **107790**
Zero Set Point: **4.56** Last Calibrated: **NA**
Range: **0.5 ppm**

O ₃ Audit Point	PPM Input (X)	PPM DAS (Y)	PPM Dif (%)
1	0.000	0.000	
2	0.036	0.037	2.8
3	0.085	0.087	2.4
4	0.185	0.187	1.1

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

Audit Statistics	
Slope:	1.010
Intercept:	0.000
Correlation:	1.0000

Comments: No problems were noted.

Audit Equipment	Make	Model	ID	Certification Date
Dilution System:	API	M700EU	83	9/3/19
Ozone Standard:	API	M700EU	83	05/28/19
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: 0.9887
	Certification Intercept: 0.0000 ppm

AUDIT RECORD



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HORIZONTAL WIND DIRECTION

Date: **09/12/19**
Start: **10:30 PST**
Finish: **11:35 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

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

Manufacturer: **Climatronics**
Serial No.: **4678**
K factor: **30**
Range: **0 - 360°**
Crossarm: **180°**
Last Calibrated: **NA**

Model: **100075**
Sensor Ht.: **10 meters**
Starting torque: **4 gm cm**
Starting threshold: **0.82 mph**
Starting threshold criteria: **1.1 mph**

Audit Point	Degrees Reference	Degrees DAS	Diff. Degrees
1	360	207	-153
2	90	89	-1
3	180	178	-2
4	270	268	-2

Audit Criteria ± 5 degrees

Comments: The 360 deg point indicated 207 on the DAS when the vane was completely still. When the wind vain was slightly rotated to the left and right of 360 the DAS showed 360 deg. It was recommended to the site operator to purchase a new sensor and return the current sensor to the Climatronics for refurbishing.

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AMBIENT TEMPERATURE

Date: **09/12/19**
Start: **10:30 PST**
Finish: **11:35 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

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

Manufacturer: **Climatronics**
Serial No.: **6916**
Lower Range: **-22** **Deg F**
Upper Range: **122** **Deg F**
Last Calibrated: **NA**

Model: **62**
Sensor Ht.: **9 m**

Audit Point	Input Deg F	DAS Deg F	Diff. Deg F
1	33.2	33.3	0.1
2	68.2	68.0	-0.2
3	106.1	106.4	0.3

Audit Criteria: ± 1.8 degrees Fahrenheit

Comments: No problems were noted.

AUDIT RECORD

T&B Systems

25570 Rye Cyn Rd., Unit J

Valencia, CA 91355

(661) 294-1103

PRECIPITATION

Date: **09/12/19**

Start: **9:00 PST**

Finish: **10:00 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	1.43	35.3

Audit Criteria ±10% of input

Comments: The audit results do not meet the criteria. The site operator was aware of the high response prior to the audit.

AUDIT RECORD

SOLAR RADIATION



25570 Rye Cyn Rd., Unit J
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Date: **9/12/19**
Start: **9:30 PST**
Finish: **10:30 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

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

Sensor Mfg: **K&Z**
Serial No.: **113299**
Range: **0 - 2.145 Langleys/min**
Last Calibrated: **NA**

Model: **SP-Lite**
Sensor Ht.: **8 meters**

Audit Point	Input L/min	DAS L/min	% Diff
1	0.938	0.866	-7.7
2	1.065	1.027	-3.6
3	1.117	1.075	-3.8
4	1.222	1.175	-3.8

Criteria: $\pm 10\%$

Comments: No problems were noted.

AUDIT RECORD



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PRESSURE

Date: **09/12/19**
Start: **10:30 PST**
Finish: **11:35 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

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

Manufacturer: **Climatronics**
Serial No.: **87**
Units: **mb**
Last Calibrated: **NA**

Model: **1022761**
Sensor Ht.: **2 m**

Audit Point	Input mb	DAS mb	Diff. mb
1	879.1	877.1	-2.0

Audit Criteria: ± 3.0 mb

Comments: There were no problems noted.

AUDIT RECORD



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RELATIVE HUMIDITY

Date: **09/12/19**
Start: **10:30 PST**
Finish: **11:35 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

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

Sensor Mfg: **Climatronics**
Serial No.: **NA**
Range: **0-100 %**
Last Calibrated: **NA**

Model: **NA**
Sensor Ht.: **9 meters**

Audit Point	Input RH (%)	DAS RH (%)	Diff. %
1	11.9	13.6	1.7
2	11.5	13.8	2.3
3	14.0	13.9	-0.1

Criteria: ± 10%

Comments: No problems were noted.

AUDIT RECORD

PM₁₀



25570 Rye Cyn Rd., Unit J
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Date: **09/12/19**
Start: **12:45 PST**
Finish: **13:45 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

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

Sampler: **TEOM (PM10)**
Serial No.: **1405A231661508**
Last Calibrated.: **May-19**

Make: **Thermo**
Model: **1405**

Amb. Press: **25.87 in. Hg**
Amb. Temp.: **28.1 °C**

Flowmeters
Model: **BGI Challenger**

T Case (°C): **50.00**
T Air (°C): **50.00**

T Cap (°C): **50.00**
F Main (lpm): **3.00**
F Aux (lpm) **13.67**

	Audit	Site	Diff.
Main	3.00 lpm	3.00 lpm	0.0%
Bypass	13.67 lpm	13.67 lpm	0.0%
Total	16.67 lpm	16.67 lpm	0.0%
Amb T	28.1 °C	28.2 °C	0.1
Amb P	0.865 atm	0.863 atm	-0.002

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: -0.02 lpm <0.60 lpm

Mass Transducer Calibration Verification

Cal Filter Weight (g)	Frequency (w/o filter) (Hz)	Frequency (with filter) (Hz)	Audit K₀	Actual K₀	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}

T&B Systems

25570 Rye Cyn Rd., Unit J
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Date: **09/12/19**
Start: **12:45 PST**
Finish: **13:45 PST**
Auditor: **David Yoho**
Witness: **Emma Ruppell**

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

Sampler: **TEOM (PM2.5)**
Serial No.: **250054**
Last Calibrated.: **May-19**

Make: **R&P**
Model: **1400A**

Amb. Press: **25.87 in. Hg**
Amb. Temp.: **29.8 °C**

Flowmeters
Model: **BGI Challenger**

T Case (°C): **30.00**
T Air (°C): **30.00**

T Cap (°C): **30.00**
F Main (lpm): **3.00**
F Aux (lpm) **13.68**

	Audit	Site	Diff.
Main	3.01 lpm	3.00 lpm	-0.3%
Bypass	13.47 lpm	13.68 lpm	1.6%
Total	16.48 lpm	16.68 lpm	1.2%
Amb T	29.8 °C	31.2 °C	1.4
Amb P	0.865 atm	0.861 atm	-0.004

*Audit Criteria: Flow - ± 4%; Total 15.87 - 17.54 lpm
Amb T - ± 2 °C
Amb P - ± 0.013 atm*

Leak Check

Main: 0.76 lpm Audit Criteria: <0.15 lpm
Bypass: 1.85 lpm <0.60 lpm

Mass Transducer Calibration Verification

Cal Filter Weight (g)	Frequency (w/o filter) (Hz)	Frequency (with filter) (Hz)	Audit K₀	Actual K₀	Error (%)
NA	NA	NA	NA	NA	NA

Audit Criteria: ± 2.5%

Comments: A leak was measured within the bypass and main flow channels during the leak check. Diagnosis and repair of the leaks is recommended.