Testing Report - $PM_{2.5}$ Base Testing

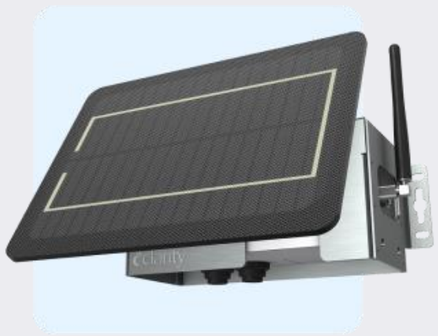
Clarity Node-S

This report reflects the v2.1 Global $PM_{2.5}$ Calibration performance

Reno, NV

Northern Nevada Public Health Air Quality Management Division

June 2024—October 2024



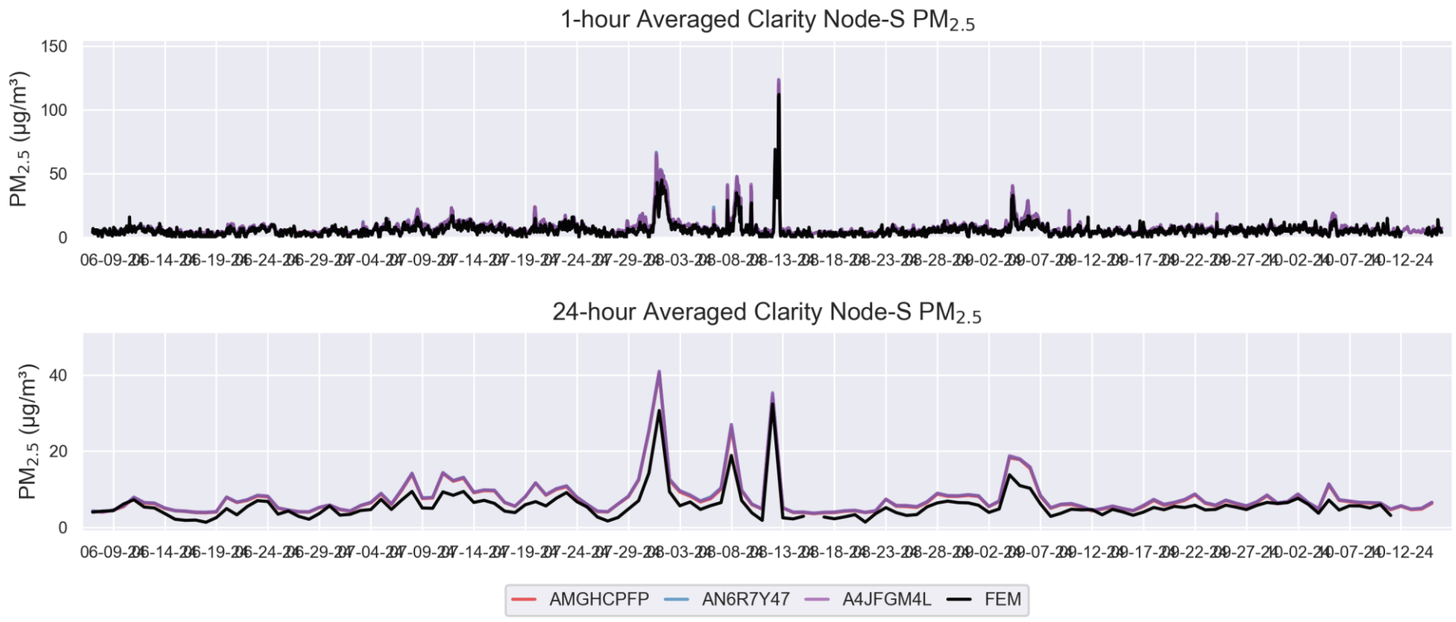
Deployment Details

Testing Organization and Site Information	
Testing organization (Name, Organization type, Contact website)	Northern Nevada Public Health Air Quality Management Division
Testing location (City, State, Latitude and Longitude)	Reno4 Reno, NV 39.52, -119.8
AQS site ID	32-031-0031
Sampling timeframe (MM-DD-YY)	06-07-24 to 10-15-24
Sensor data source	Clarity Cloud
Reference data source	$PM_{2.5}$: AirNow API Meteorological: Files from NNPH

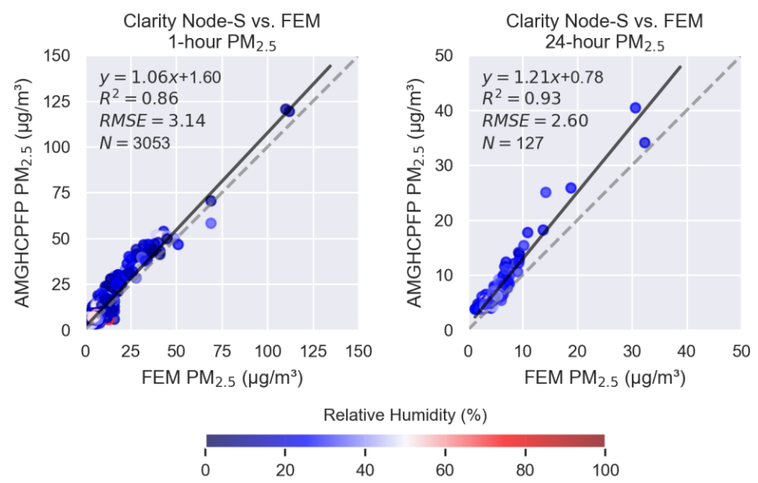
Sensor Information			
Manufacturer, model	Clarity Node-S		
Device firmware version	2.4.1.01		
Sampling time interval	1-hour		
Sensor serial numbers	AMGHCPFP	AN6R7Y47	A4JFGM4L
Issues encountered during deployment?	☐	No Issues	

FRM/FEM Information	
Manufacturer, model, designation	Met One Instruments, Inc. BAM-1020 VSCC
Sampling time interval	1 Hour
Date of calibration	07/15/24 (BP cal only) 08/14/24 (BP cal only) 10/07/24 (BP cal only)
Date of flowrate verification check	06/17/24, 07/01/24, 07/15/24, 07/31/24, 08/14/24, 08/26/24, 09/09/24, 09/23/24, 10/07/24, 10/14/24 – semi-annual flow audit
Description, date(s) of maintenance activities	06/17/24 – smart heater, RH, and filter temp test; span membrane test, beta detector count, dark count 07/01/24 – PM10 inlet, PM2.5 VSCC, nozzle, vane, capstan shaft, and pinch roller maint 07/11/24 – filter tape replacement 07/31/24 – PM10 inlet, PM2.5 VSCC, nozzle, vane, capstan shaft, and pinch roller maint 08/26/24 – PM10 inlet, PM2.5 VSCC, nozzle, vane, capstan shaft, and pinch roller maint 09/09/24 – filter tape replacement 09/23/24 – PM10 inlet, PM2.5 VSCC, nozzle, vane, capstan shaft, and pinch roller maint

Time Series Plots



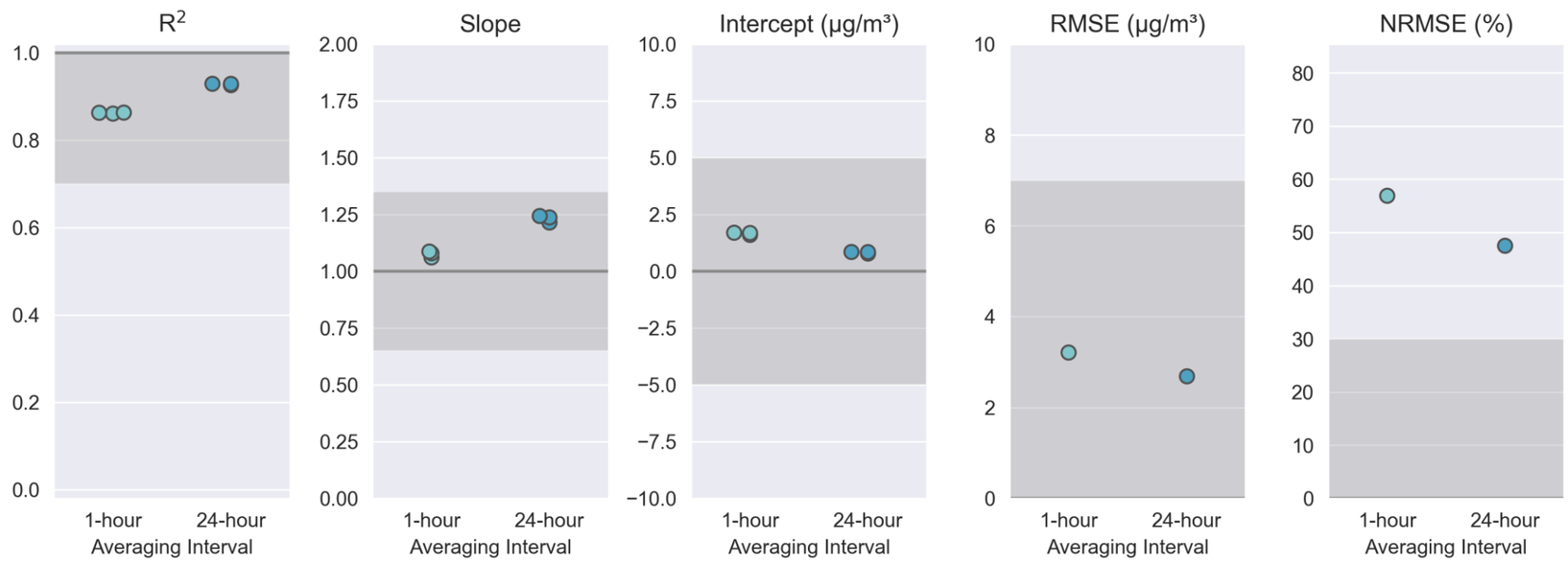
Scatter Plots: Comparison to FRM/FEM



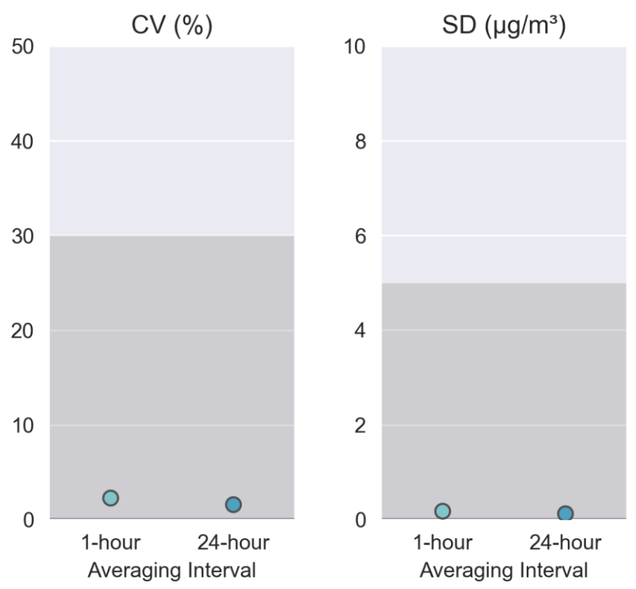
Range of FRM/FEM concentrations over duration of base test (µg/m³)	[1-hr] -3.0-112.0, avg: 5.6, [24-hr] 1.3-32.3, avg: 5.7
Number of 24-hr periods in FRM/FEM monitor measurements with a goal concentration ≥ 25 µg/m³	2

Performance Metrics

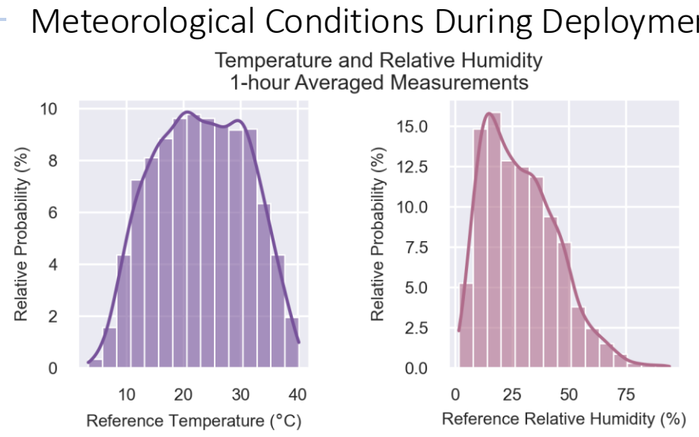
Sensor-FRM/FEM Accuracy



Sensor-Sensor Precision

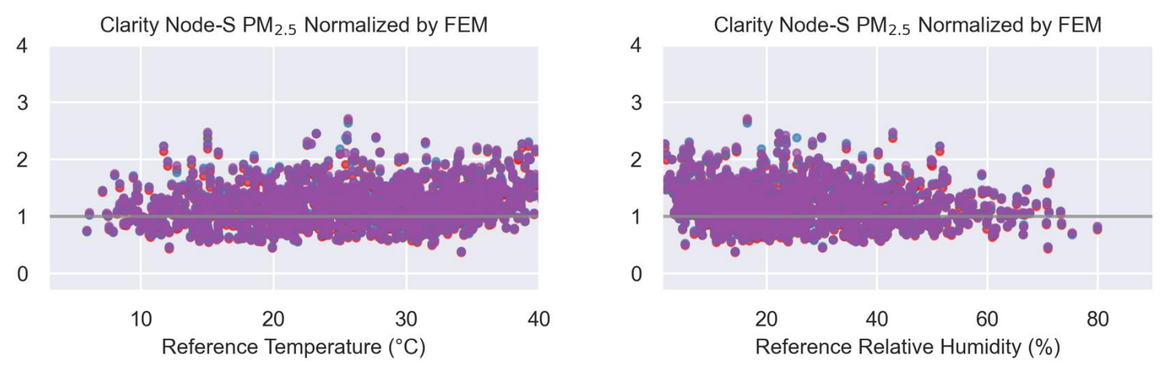


Meteorological Conditions During Deployment



Number of 24-hr periods outside sensor manufacture-listed temperature operational range (no operational range specified)	-
Number of 24-hr periods outside sensor manufacture-listed relative humidity operational range (no operational range specified)	-

Meteorological Influence



Mean number of paired, normalized concentration and temperature values (1-hr averages)	3116
Mean number of paired, normalized concentration and relative humidity values (1-hr averages)	3116

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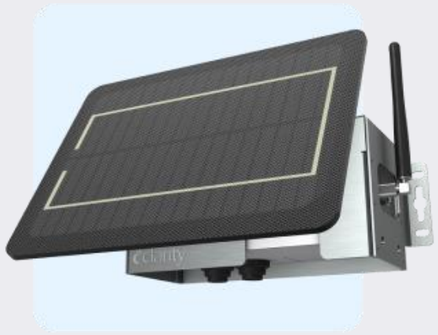

Tabular Statistics

Sensor-FRM/FEM Correlation

	Bias and Linearity						Data Quality			
	R^2		Slope		Intercept (µg/m³)		Uptime (%)		Number of paired sensor and FRM/FEM concentration values	
	1-Hour ●●●	24-Hour ●●●	1-Hour ●●●	24-Hour ●●●	1-Hour ●●●	24-Hour ●●●	1-Hour ●●●	24-Hour ●●●	1-Hour	24-Hour
Metric Target Range	≥ 0.70	≥ 0.70	1.0 ± 0.35	1.0 ± 0.35	-5 ≤ b ≤ 5	-5 ≤ b ≤ 5	75%*	75%*	-	-
Sensor AMGHCPFP	0.86	0.93	1.06	1.21	1.60	0.78	100	100	3053	127
Sensor AN6R7Y47	0.86	0.93	1.08	1.24	1.69	0.85	100	100	3055	127
Sensor A4JFGM4L	0.86	0.93	1.09	1.24	1.68	0.84	100	100	3054	127
Mean	0.86	0.93	1.08	1.23	1.66	0.82	100	100	3054	127

	Error			
	RMSE (µg/m³)		NRMSE (%)	
	1-Hour ★	24-Hour ★	1-Hour ☆	24-Hour ☆
Metric Target Range	≤ 7.0	≤ 7.0	≤ 30.0	≤ 30.0
Deployment Value	3.2	2.7	56.9	47.5

Device-specific metrics (computed for each sensor in evaluation)
- ○○○ Metric value for none of devices tested falls within the target range
- ●○○ Metric value for one of devices tested falls within the target range
- ●●○ Metric value for two of devices tested falls within the target range
- ●●● Metric value for three of devices tested falls within the target range

Single-valued metrics (computed via entire evaluation dataset)
- ☆ Indicates that the metric value is not within the target range
- ★ Indicates that the metric value is within the target range

Sensor-Sensor Precision

	Precision (between collocated sensors)				Data Quality	
	CV (%)		SD (µg/m³)		Number of concurrent sensor concentration pairs	
	1-Hour ★	24-Hour ★	1-Hour ★	24-Hour ★	1-Hour	24-Hour
Metric Target Range	≤ 30.0	≤ 30.0	≤ 5.0	≤ 5.0	-	-
Deployment Value	2.3	1.6	0.2	0.1	3138	131

*This value is only a recommendation for ensuring data quality and is not included in the list of target values discussed in Section 4 of the Performance Testing Protocols, Metrics, and Target Values for Fine Particulate Matter Air Sensors document.

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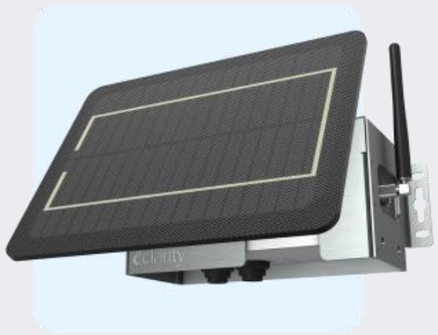

Sensor-FRM/FEM Scatter Plots