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WELD COUNTY MONITORING NETWORK

AIR QUALITY AND METEOROLOGICAL MONITORING DATA: 3RD QUARTER 2025 SUMMARY REPORT

RAMBOLL

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ACRONYMS AND ABBREVIATIONS

agl	Above Ground Level
pH	Acidity
NH_3	Ammonia
AMoN	Ammonia Monitoring Network
NH_4	Ammonium
Br	Bromide
Ca	Calcium
Cl	Chloride
CAAQS	Colorado Ambient Air Quality Standards
°C	Degrees Celsius
GHG	Greenhouse Gas
In/hr	Inches per hour
Mg	Magnesium
m	Meter
m/s	Meters per second
$\mu g/m^3$	Micrograms per meter cubed
µS/cm	Micro-Siemens per centimeter
mg/m^3	Milligrams per meter cubed
mmHg	Millimeters of mercury
mm/hr	Millimeters per hour
MSP	Missile Site Park
NAAQS	National Ambient Air Quality Standards
AAQS	National Ambient Air Quality Standards and Colorado Ambient Air Quality Standards
NADP	National Atmospheric Deposition Program
NTN	National Trends Network
NO_3	Nitrate
NO_2	Nitrogen Dioxide
NO	Nitrogen Oxide
NO_x	oxides of nitrogen
ppb	parts per billion
ppm	parts per million

PO_4	Phosphate
K	Potassium
QAPP	Quality Assurance Project Plan
RH	Relative Humidity
Na	Sodium
SO_4	Sulfate
TAPI	Teledyne Advanced Pollution Instrumentation
W/m^2	Watts per square meter

1. QUARTER 3 2025 MONITORING HIGHLIGHTS

Data Completeness

- All data completeness goals were met for all parameters at all three sites, with solar radiation at MSP being the one exception. Data completeness was 89.58%, just shy of the goal of 90%.

Ozone

- **Values to date:** The year-to-date 4th highest daily maximum 8-hour average (MDA8) ozone concentration at all three sites are below both the 2008 and 2015 federal health-based standards, at 68 ppb, 67 ppb, and 66 ppb for MSP, Hereford, and Orchard, respectively.

- **Spatial trends:** In Quarter 3 (Q3) 2025, the 1st highest MDA8 for all three sites were very similar (65-67 ppb). In other years the spread of the first highest MDA8 across sites has been greater. For comparison in Q3 2024 the first highest MDA8 at each site ranged from 78 to 91ppb, and in Q3 2023 it ranges from 62 to 71ppb.

- **Annual trends:** Year-to-date MDA8 ozone concentrations at all sites are much lower than recent years. For comparison in Q3 2024, the 4th highest MDA8 at all three sites were significantly higher at 80 ppb, 77 ppb, and 72 ppb for MSP, Hereford, and Orchard, respectively.

- **Exceedances:** Year-to-date, one 2015 NAAQS exceedance occurred at MSP in Q2, and none in Q3. Year-to-date, measured concentrations at Hereford and Orchard remain below 2015 ozone standard, and measured concentrations at all sites remain below the 2008 ozone standard.

Nitrogen Dioxide (NO_2)

- **Values:** Q3 concentrations at MSP are well below federal annual and 1-hour health-based standards.

- **Annual trend:** Year-to-date annual mean NO_2 value to date is 5.2 ppb, which is comparable to past years such as Q3 2024 when the value was 5.9 ppb.

Quarterly Events

- **Climate trends:** Q3 2025 was slightly warmer than normal with temperatures in Weld County approximately 1-2 °F warmer than normal. Southeastern Weld County was slightly drier than normal with 1.5 inches less precipitation than normal, while northeastern Weld County was wetter than normal at up to 6 inches more precipitation than normal.[1]

- **Summary of non-routine site visits:** MSP had 5 in person visits and 8 virtual visits to troubleshoot parts of the gas analyzer systems. Hereford had 2 virtual visits to troubleshoot the gas analyzer system. Orchard had 1 in person visits and 2 virtual visits to troubleshoot the gas analyzer system and the precipitation gauge.

[1] High Plains Regional Climate Center, *ACIS Climate Maps*. Available at: https://hprcc.unl.edu/maps.php?map=ACISClimateMaps Accessed: October 2025.

2. INTRODUCTION AND REPORT SUMMARY

In 2020, Weld County commissioned the installation and operation of an air quality and meteorological monitoring network consisting of three monitoring stations located in areas that do not have existing air quality monitoring stations. The purpose of the monitoring network is to collect ambient air quality and meteorological data to inform current and future air quality management actions and policies. Weld County monitoring objectives support a wide variety of air quality management goals that were developed in consideration of current and expected future regulatory drivers related to ozone (O_3), greenhouse gases (GHG), and nitrogen air pollutants. The three stations are named Missile Site Park (MSP), Hereford, and Orchard and their locations are shown in **Figure 1**. MSP was operational and began collecting data on November 16, 2020. Hereford was operational and began collecting data on December 16, 2020. Orchard was operational and began collecting data on December 30, 2020.

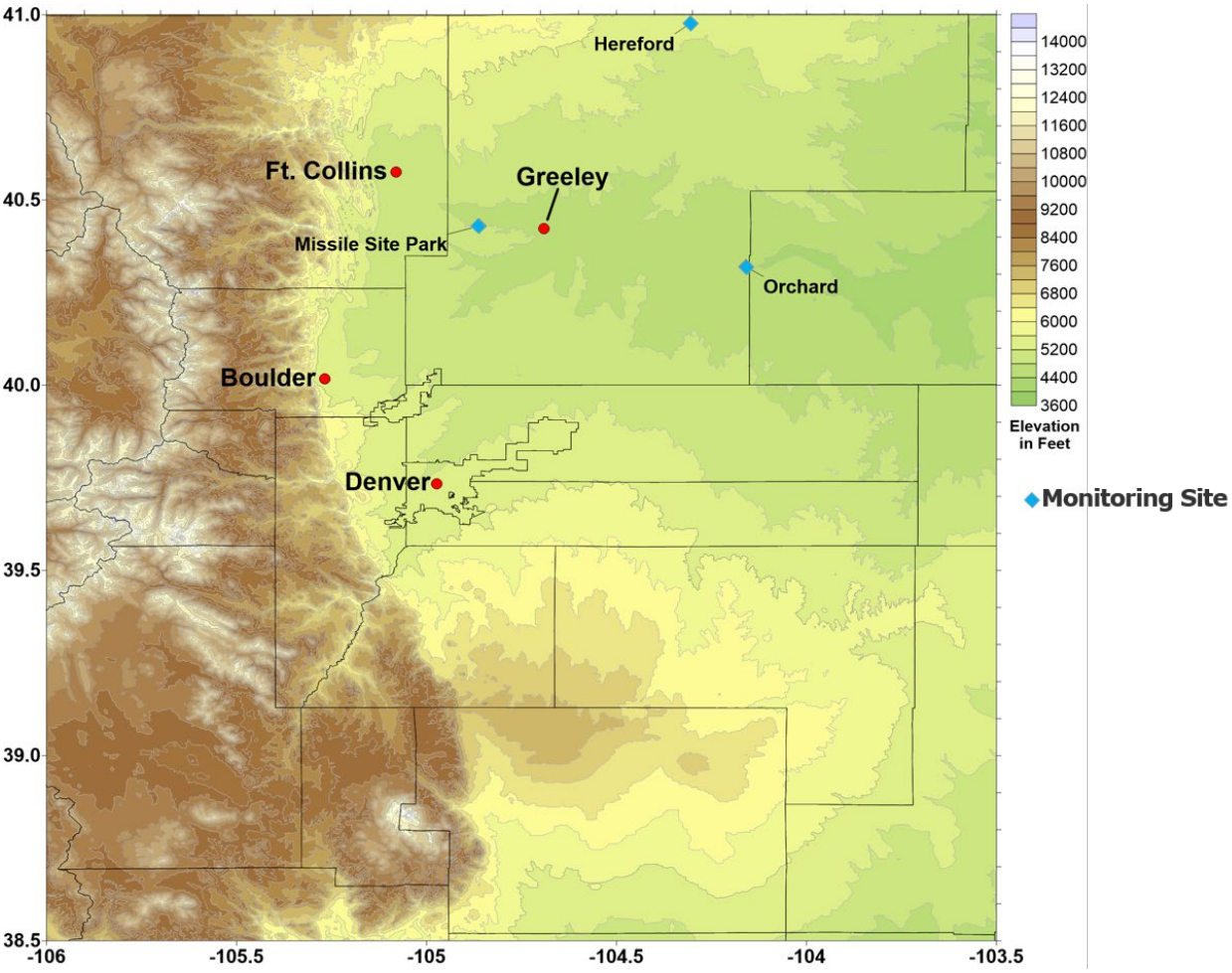


Figure 1. Weld County Monitoring Station Locations

All three monitoring stations measure O_3 concentrations and a full suite of meteorological parameters. A complete list of all collected meteorological measurements is included in **Chapter 3** of this report. In addition, oxides of nitrogen (NO_X) concentrations, measured as NO_X, nitrogen dioxide (NO_2) and

nitrogen oxide (NO) are measured at MSP. Lastly, gaseous ammonia and precipitation chemistry are measured at MSP and Orchard. Based on the *Weld County Air Monitoring Network Assessment*,[2] it was recommended to monitor these compounds at these locations to best support Weld County's near-term data needs and air quality management goals. The Weld County Air Monitoring Network Assessment[3] considered locations of existing monitors, concentration trends, and spatial distributions of emissions.

Collected data are publicly accessible in three ways:

1. Meteorological data, such as precipitation, wind direction, and temperature, are publicly available in real-time for the most recent three days at the Weld County Meteorological Dashboard.[4]

2. Summary and analysis of collected air quality and meteorological data is available in quarterly and annual reports on the Weld County Air Quality Reports and Documents website.[5]

3. Validated and quality-assured air quality and meteorological data is available upon request by contacting the Weld County Department of Public Health and Environment at 970-400-6415.

Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Quarterly Report for Weld County's air quality and meteorological monitoring program to summarize the final, validated data and provide transparent, publicly available documentation regarding the quality assurance and quality control procedures. This report for the 3rd quarter of 2025 (Q3 2025) provides a monthly, quarterly, and year-to-date summary of all air quality and meteorological data collected at Weld County's monitoring stations during the period from July 1, 2025 through September 30, 2025. Details regarding the monitoring program, the three monitoring station locations, equipment specifications, and quality assurance procedures are included in the following sections. Lastly, a comprehensive summary of Q3 2025 data is presented in comparison to National Ambient Air Quality Standards (NAAQS) and Colorado Ambient Air Quality Standards (CAAQS) to help readers understand how measurements compare to federal and state air quality standards.

NAAQS and CAAQS are collectively referred to as "AAQS". The AAQS for O_3 and NO_2 are listed in **Table 1** below. For O_3 there are two different AAQS: one standard of 0.075 part per million (ppm), which was established in 2008, and a more restrictive O_3 standard of 0.070 ppm, which was established in 2015. Both standards are still in effect; therefore, measured O_3 concentrations are compared to both standards. Similarly, for NO_2 there are two different AAQS: one standard is 100 parts per billion (ppb) for a 1-hr average and another standard is 53 ppb for a yearly average.

Both O_3 and NO_2 AAQS have both a "Primary" standard and a "Secondary" standard. The Primary standard is for protection of public health while the Secondary standard is for protection of public

[2] Ramboll, Air Monitoring Network Assessment, 2020. Available by request.

[3] Id.

[4] https://weldgov.maps.arcgis.com/apps/dashboards/15dbeaa327a84c44a403abfb7e996e80

[5] https://www.weld.gov/Government/Departments/Health-and-Environment/Environmental-Health-Services/Air-Quality/Weld-County-Air-Quality-Reports-and-Publications

welfare (such as protection against damage to crops, animals, and vegetation). For O_3 and NO_2, the level of the Primary and the Secondary standards are the same.

Meteorology measurements for Q3 2025 were all within normal ranges for the area and season. At all three stations, average temperatures were coldest during September and warmest during July. Average solar radiation gradually decreased as the quarter progressed at all three sites while maximum solar radiation occurred in July at all sites. Total monthly precipitation peaked in August at MSP, and in July at Hereford and Orchard, while maximum hourly precipitation occurred in August at MSP, and July at Hereford and Orchard. Continuous gaseous pollutant measurements for Q3 2025 indicate that all three stations generally had good air quality. Concentrations remained below the respective AAQS values for NO_2, and O_3 did not have any MDA8 exceedances of the 2008 ozone AAQS. The maximum hourly average O_3 concentration at each site was 78 ppb on July 1st and 2nd at MSP, 73 ppb on July 17th at Hereford, and 69 ppb on July 8th, 13th and July 18th at Orchard. At MSP, the highest hourly average NO_2 recorded during Q2 2025 was 16.4 ppb on September 30th.

It is important to note that O_3 and NO_2 measurements have now been collected for more than three years, enabling measurements to be compared to AAQS. The measured concentrations are compared to AAQS for informational purposes in Chapter 5 of this report.

Table 1. AAQS for O_3 and NO_2

Pollutant (Year)	Primary/ Secondary	Averaging Time	Level	Form
O_3 (2015)	Primary & Secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentrations, averaged over 3 years
O_3 (2008)	Primary & Secondary	8 hours	0.075 ppm	Annual fourth-highest daily maximum 8-hour concentrations, averaged over 3 years
NO_2	Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Primary & Secondary	1 year	53 ppb	Annual Mean

Notes
O_3 ozone
NO_2 nitrogen dioxide
ppb parts per billion
ppm parts per million

Adapted from the NAAQS Table available here: https://www.epa.gov/criteria-air-pollutants/naaqs-table

3. SUMMARY OF MONITORING PROGRAM

3.1 Monitoring Station Locations

The three Weld County air quality station locations were guided by the *Weld County Air Monitoring Network Assessment*[6] which analyzed Weld County's monitoring objectives, existing monitoring stations, and emissions source locations to determine high priority areas to conduct monitoring. Final station locations were determined in consideration of logistical requirements such as accessibility, availability of power, and proximity of large emissions sources which could affect the representativeness of station measurements. Weld County's monitoring network consists of three stations:

- MSP is the primary monitoring station and is located northwest of Greeley, CO. MSP monitors O_3, oxides of nitrogen (NO_x), wet deposition via the National Trends Network (NTN), gaseous ammonia via the Ammonia Monitoring Network (AMoN), and meteorological parameters from a 10-meter (m) tower; and
- Hereford is a secondary station located in north-central Weld County and monitors O_3 and meteorological parameters from a 10-m tower; and
- Orchard is also a secondary station located in eastern Weld County to monitor O_3, wet deposition via the NTN, ammonia via the AMoN, and meteorological parameters from a 10-m tower.

For exact coordinates and elevation of each station, see **Table 2** below.

Table 2. Coordinates and Elevations of Monitoring Stations

Monitoring Statio	Latitude	Longitude	Elevation
MSP	40.428943° N	104.861474° W	4,960 Feet
Hereford	40.977351° N	104.305184° W	5,311 Feet
Orchard	40.319874° N	104.159449° W	4,464 Feet

3.2 Monitoring Instrumentation

The installation, configuration, calibration, and integration of the monitoring network along with technical specifications for all equipment and monitoring systems are summarized in the *Weld County Ambient Air Monitoring Program Quality Assurance Project Plan* (QAPP), referred to hereafter as the QAPP.[7] Weld County's monitoring program is conducted in accordance with the QAPP.

Table 3 and **Table 4** summarize the key air quality and meteorological monitoring equipment and measurement specifications for the Weld County stations. The monitoring systems, sampling frequencies, quality assurance program, and data management aspects of the monitoring program are described in the QAPP.[8]

[6] Ramboll, Air Monitoring Network Assessment, 2020. Available by request.

[7] Ramboll, Weld County Ambient Air Monitoring Program Quality Assurance Project Plan (QAPP), December 20th, 2024. Available at: https://www.weld.gov/files/sharedassets/public/v/1/departments/health-and-environment/documents/environmental-health/weldco_aq_qmp_qapp_dec-20-2024.pdf. Accessed October 2025.

[8] Id.

Table 3. Weld County Air Quality Monitoring Station Equipment Specifications

Measurement	Manufacturer	Model	Serial Number	Zero and Span Noise	Detection Limit	Drift Over 24-hour Period	Response Time	Units
Missile Site Park								
O_3	TAPI	T400	5986	<0.2 ppb @ 0 ppb & <0.5% reading above 100 ppb	<0.4 ppb	<1 ppb @ 0 ppb & <1% of reading @ span	<30 seconds to 95%	ppb, ppm, $\mu g/m^3$, mg/m^3
NO_x	TAPI	T200 (w/ sample conditioner; part number KIT000262)	6727	<0.1 ppb @ 0 ppb & <0.2% reading above 50 ppb	<0.2 ppb	<0.5 ppb @ 0 ppb & <0.5% of reading @ full scale	<80 seconds to 95%	ppb, ppm, $\mu g/m^3$, mg/m^3
Gas Dilution/O_3 Transfer Standard	TAPI	T700	4969	1% of reading (linearity)	N/A	<1.0 ppb @ 0 ppb	<20 seconds to 95% (photometer response)	N/A
Zero Air Generator	TAPI	T701	1961	NO/NO_2 < 0.1 ppb; O_3 < 0.4 ppb	N/A	N/A	N/A	N/A
NH_3	Radiello	N/A	N/A	N/A	0.083 mg/L (Network) 0.013 mg/L (Lab)	N/A	N/A	N/A

Measurement	Manufacturer	Model	Serial Number	Zero and Span Noise	Detection Limit	Drift Over 24-hour Period	Response Time	Units
National Trends Network	N/A	N/A	N/A	N/A	Ca (0.023 mg/L) Mg (0.006 mg/L) K (0.005 mg/L) Na (0.010 mg/L) Br (0.006 mg/L) NH_4 (0.017 mg/L) NO_3 (0.018 mg/L) Cl (0.018 mg/L) SO_4 (0.018 mg/L) PO_4 (0.010 mg/L) Conductance (µS/cm) pH	N/A	N/A	N/A
Orchard								
O_3	TAPI	T400	5985	<0.2 ppb @ 0 ppb & <0.5% reading above 100 ppb	<0.4 ppb	<1 ppb @ 0 ppb & <1% of reading @ span	<30 seconds to 95%	ppb, ppm, $\mu g/m^3$, mg/m^3
O_3 Transfer Standard	TAPI	T703	824	±1% of full scale (linearity)	N/A	<1 ppb @ 0 ppb (7 days) & <1% @ span	<20 seconds to 95% (photometer response)	N/A
NH_3	Radiello	N/A		N/A	0.083 mg/L (Network) 0.013 mg/L (Lab)	N/A	N/A	N/A

Measurement	Manufacturer	Model	Serial Number	Zero and Span Noise	Detection Limit	Drift Over 24-hour Period	Response Time	Units
National Trends Network	N/A	N/A	N/A	N/A	Ca (0.023 mg/L) Mg (0.006 mg/L) K (0.005 mg/L) Na (0.010 mg/L) Br (0.006 mg/L) NH_4 (0.017 mg/L) NO_3 (0.018 mg/L) Cl (0.018 mg/L) SO_4 (0.018 mg/L) PO_4 (0.010 mg/L) Conductance (µS/cm) pH	N/A	N/A	N/A
Hereford								
O_3	TAPI	T400	5984	<0.2 ppb @ 0 ppb & <0.5% reading above 100 ppb	<0.4 ppb	<1 ppb @ 0 ppb & <1% of reading @ span	<30 seconds to 95%	ppb, ppm, $\mu g/m^3$, mg/m^3
O_3 Transfer Standard	TAPI	T703	825	±1% of full scale (linearity)	N/A	<1 ppb @ 0 ppb (7 days) & <1% @ span	<20 seconds to 95% (photometer response)	N/A

Notes:

O_3	Ozone	ppb	parts per billion	Mg	Magnesium	NH_4	Ammonium
NO_x	Oxides of nitrogen	ppm	parts per million	K	Potassium	NO3	Nitrate
NH_3	Ammonia	$\mu g/m^3$	Micrograms per meter cubed	Na	Sodium	Cl	Chloride
mg/m^3	Milligrams per meter cubed			Br	Bromide	SO_4	Sulfate
PO_4	Phosphate	Ca	Calcium	pH	Acidity	TAPI	Teledyne Advanced Pollution Instrumentation
		µS/cm	Micro-Siemens per centimeter				

Table 4. Weld County Meteorological Monitoring Station Equipment Specifications

Measurement	Count	Tower Location (m)	Manufacturer	Model	Serial Number	Accuracy	Range	Description
Missile Site Park								
Wind speed & direction	1	10	R.M. Young	05305V	180188	±0.2 m/s & ±3 degrees	0-50 m/s 0-355 deg	Wind monitor
Ambient temperature/Vertical temperature difference	2	2m and 10m	R.M. Young	41342VC	32951 (2 m) 32952 (10 m)	±0.1 °C	-50 to 50°C	Temperature probe with radiation shield
Relative humidity (RH)	1	2	Campbell Scientific/E+E Elektronik	EE181	20151600125038	±1.3% RH [1]	0-100%	Relative humidity and temperature sensor
Solar radiation	1	2	Hukseflux	LP02	48019	<0.15% per °C	0-2000 W/m^2	Thermal pyranometer
Barometric pressure	1	2	Setra	278	7563464	±1.5 hPa^2	450-825 mmHg	Barometric pressure sensor
Precipitation	1	Ground	R.M. Young	52202	TB16137	2%-3% [3]	0-50 mm/hr	Heated tipping bucket rain gauge
Precipitation-NTN	1	Ground	ETI Instrument Systems	NOAH IV	4310	±0.254 mm	0-280 in/hour	Weight-based rain gauge
Collection bucket-NTN	1	Ground	N-CON	00-120-2N	60441	N/A	N/A	Wet deposition collection buckets
Orchard								
Wind speed & direction	1	10	R.M. Young	05305V	180186	±0.2 m/s & ±3 degrees	0-50 m/s 0-355 deg	Wind monitor
Ambient temperature/Vertical temperature difference	2	2m and 10m	R.M. Young	41342VC	32953 (2 m) 32954 (10 m)	±0.1 °C	-50 to 50°C	Temperature probe with radiation shield

Measurement	Count	Tower Location (m)	Manufacturer	Model	Serial Number	Accuracy	Range	Description
Relative humidity	1	2	Campbell Scientific/E+E Elektronik	EE181	201516001269F1	±1.3% RH [1]	0-100%	Relative humidity and temperature sensor
Solar radiation	1	2	Hukseflux	LP02	48014	<0.15% per °C	0-2000 W/m^2	Thermal pyranometer
Barometric pressure	1	2	Setra	278	7563445	±1.5 hPa [2]	450-825 mmHg	Barometric pressure sensor
Precipitation	1	Ground	R.M. Young	52202	TB16138	2% - 3% [3]	0-50 mm/hr	Heated tipping bucket rain gauge
Precipitation-NTN	1	Ground	ETI Instrument Systems	NOAH IV	4311	±0.254 mm	0-280 in/hour	Weight-based rain gauge
Collection bucket-NTN	1	Ground	N-CON	00-120-2N	60442	N/A	N/A	Wet deposition collection buckets
Hereford								
Wind speed & direction	1	10	R.M. Young	05305	209492	±0.2 m/s & ±3 degrees	0-50 m/s 0-355 deg	Wind monitor
Ambient temperature/Vertical temperature difference	2	2m and 10m	R.M. Young	41342VC	32950 (2 m) 32869 (10 m)	±0.1 °C	-50 to 50°C	Temperature probe with radiation shield
Relative humidity	1	2	Campbell Scientific/E+E Elektronik	EE181	2015160012638F	±1.3% RH [1]	0-100%	Relative humidity and temperature sensor
Solar radiation	1	2	Hukseflux	LP02	48015	<0.15% per °C	0-2000 W/m^2	Thermal pyranometer
Barometric pressure	1	2	Setra	278	7573233	±1.5 hPa [2]	450-825 mmHg	Barometric pressure sensor
Precipitation	1	Ground	R.M. Young	52202	TB16139	2% - 3% [3]	0-50 mm/hr	Heated tipping bucket rain gauge

Notes:

%	Percent	m/s	Meters per second	W/m^2	Watts per meter squared
ºC	Degrees Celsius	RH	Relative humidity	mmHg	Millimeters of mercury
mm/hr	Millimeters per hour	deg	Degrees	in/hour	Inches per hour

[1] The manufacturer specifies an accuracy range based on a temperature range -15 to 40 °C and RH between 0 and 90%. Above 90% RH, the accuracy decreases to ±2.3% RH

[2] This accuracy range is achieved when the temperature is between -20 to 50 °C.

[3] This accuracy is 2% when the precipitation rate is 25 mm/hr or less and the accuracy is 3% when the precipitation rate is between 25 mm/hr and 50 mm/hr.

4. MONITORING METHODOLOGY

4.1 Data Collection, Management and Storage

All meteorological and gas analyzer data are collected on a continuous basis using a Campbell Scientific Inc. (Campbell) CR3000 data logger. Data are then output to files on 15-minute, 60-minute, and 24-hour frequency. Custom 1-minute and 15-minute tables are also stored by the logger for gaseous calibration tracking and public access of meteorology, respectively. Data files are stored on the CR3000. All three stations are programmed to automatically download and save files from the CR3000 to a Ramboll computer daily. Data files are also manually saved to a separate Ramboll computer several times per week.

Real-time meteorological data for all three stations are also available on the Weld County Public Health Department website[9]. Plots on the Weld County website provide wind speed, maximum wind gusts, wind direction, surface temperature, and precipitation for 15-minute intervals. Data are shown for the previous three days and are updated every 30 minutes.

4.2 Quality Assurance/Quality Control

The quality assurance objectives for this monitoring program are documented in the QAPP. These objectives are designed to be consistent with those outlined in 40 CFR Part 58 Appendix A, *US EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume II: Ambient Air Monitoring Program*, and *US EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV: Meteorological Measurements* (together, the "QA Handbooks").[10,11] The QA Handbooks specify the minimum system requirements applicable to data collection and quality assurance requirements for ambient air quality pollutants and meteorological measurements.

4.2.1 Accuracy and Performance Audits

The audit procedures for this monitoring program include semi-annual audits in accordance with the QAPP.[12] Audits will be performed in calendar Quarters 2 and 4. Results from the Quarter 2 2025 audits and calibrations are available in Appendix A of the Q2 2025 Summary Report for the Weld County Monitoring Network. In this report, several ozone calibrations were performed in response to poor quality assurance results. The results of these contingency calibrations are available in **Appendix A**.

4.2.2 Calibration Protocol

The calibration procedures utilized for the project included automated routine calibration checks in accordance with the QAPP. For O_3 analyzers, calibration checks include Precision-Span-Zero checks at

[9] Weld County Meteorological Dashboard is accessible at: https://weldgov.maps.arcgis.com/apps/dashboards/15dbeaa327a84c44a403abfb7e996e80. Accessed October 2025.

[10] USEPA, *Quality Assurance Handbook for Ambient Air Quality Monitoring Volume II: Ambient Air Quality Monitoring Program*, January 2017. Available at: https://www.epa.gov/sites/default/files/2020-10/documents/final_handbook_document_1_17.pdf. Accessed October 2025.

[11] USEPA, *Quality Assurance Handbook for Ambient Air Quality Monitoring Volume IV: Meteorological Measurements*, March 2008. Available at: https://www.epa.gov/sites/default/files/2021-04/documents/volume_iv_meteorological_measurements.pdf. Accessed October 2025.

[12] Ramboll, Weld County Ambient Air Monitoring Program Quality Assurance Project Plan (QAPP), December 20, 2024. Available at: https://www.weld.gov/files/sharedassets/public/v/1/departments/health-and-environment/documents/environmental-health/weldco_aq_qmp_qapp_dec-20-2024.pdf. Accessed October 2025.

all three stations three times per week. For the NO_x analyzer at MSP, calibration checks include Precision-Span-Zero checks and gas-phase titration checks twice per week. Note that the Precision-Span-Zero check and titration checks occur on different days. The minimum frequency required per check is once every 14 days, per Appendix D of the Quality Assurance Handbook, Volume II.[13] A summary of calibration data for Q3 2025 is available in **Appendix D**. Maintenance is performed as necessary in response to measured deviations during calibrations and as part of planned routine activities during station inspections.

4.2.3 Data Completeness and Significant Events

Data completeness is calculated as the amount of valid data divided by the amount of potential data possible over a specified period, expressed as a percentage. In accordance with the QAPP, data are reviewed to determine that data are valid. Any data that is affected by known and qualifiable instrument performance problems, periods of routine maintenance, power failures, and/or site visits, or calibration/audit checks are invalidated. Hours with invalid data are removed from the final valid dataset and lower the calculated data completeness statistics. Program activities conducted during Q3 2025 included data collection, equipment programming and calibrations, station inspections, routine maintenance, equipment troubleshooting and repair, routine data acquisition, data screening and validation, and report preparation. Significant events that resulted in invalidation of data are documented in **Appendix B**, along with corrective reports detailing troubleshooting, maintenance, and repairs that occurred during the quarter. **Appendix C** contains the site access logs.

Consistent with data completeness requirements specified in the QA Handbooks, the quarterly data completeness goals are greater than or equal to (≥) 75% for NO_2 data, and ≥ 90% for meteorological data. For O_3, the data completeness goals are ≥ 75% of the daily maximum 8-hour averages of O_3 during the O_3 season, which in Colorado is January to December.[14] However, over three consecutive ozone seasons the overall data completeness must be ≥ 90% on average, thus we have set a goal of ≥ 90% for the monitoring network. A summary of data completeness targets and program results by month and for the quarter is presented in **Table 5** for all continuous monitoring systems. During Q3 2025, data losses occurred from regularly scheduled gas calibrations (484 hours), power outages (40 hours), manual gas calibrations (16 hours), machine malfunction (3 hours), instrument maintenance (32 hours), multi-point calibrations (28 hours), filter changes (18 hours), unverified quality assurance (209 hours), shelter temperature issues (6 hours), shelter climate control failure (170 hours), and wildlife damage (230 hours).

The data completeness goal for solar radiation at MSP was not met due to the sensor being covered in bird excrement. All other data completeness goals were met at each of the three sites during Q3 2025, as shown in **Table 5**.

The QA Handbooks have also established goals for instrument accuracy and precision. **Figure 2** presents a graphic that depicts the importance of accuracy and precision. **Table 6** presents the

[13] USEPA, *Quality Assurance Handbook for Ambient Air Quality Monitoring Volume II: Ambient Air Quality Monitoring Program*, January 2017. Available at: https://www.epa.gov/sites/default/files/2020-10/documents/final_handbook_document_1_17.pdf. Accessed October 2025.

[14] USEPA Ozone Seasons, February 13 2024. Available at: https://aqs.epa.gov/aqsweb/documents/codetables/ozone_seasons.html. Accessed: October 2025.

instrument accuracy and precision targets and the accuracy and precision achieved by the instruments deployed at each station during the Q2 2025 semi-annual calibrations. Results can be found in Appendix A of the Q2 2025 Summary Report for the Weld County Monitoring Network.

Table 5. 3rd Quarter 2025 Data Completeness for Continuous Measurement Devices

Measurement	Time Period	Completeness Target	Site Completeness				Target Met? (Y/N)
			Jul	Aug	Sep	Q3 2025	
Missile Site Park							
NO_2[1]	Quarterly	≥75%	93%	93%	96%	94%	Yes
NO_x, NO[1]	N/A	N/A	93%	93%	96%	94%	N/A
O_3[1]	O_3 Season	≥90%	97%	81%	100%	92%	N/A
Wind Direction[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Wind Speed[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Temperature[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Delta Temperature[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Relative Humidity[2]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Solar Radiation[2,3]	Quarterly	≥90%	100%	97%	71%	89.58%	No
Barometric Pressure[2]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Precipitation[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Hereford							
O_3[1]	O_3 Season	≥90%	97%	100%	100%	99%	N/A
Wind Direction[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Wind Speed[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Temperature[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Delta Temperature[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Relative Humidity[2]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Solar Radiation[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Barometric Pressure[2]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Precipitation[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Orchard							
O_3[1]	O_3 Season	≥90%	65%	100%	100%	88%	N/A
Wind Direction[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Wind Speed[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Temperature[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Delta Temperature[2,3]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Relative Humidity[2]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Solar Radiation[2]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Barometric Pressure[2]	Quarterly	≥90%	100%	100%	100%	100%	Yes
Precipitation[2]	Quarterly	≥90%	100%	100%	100%	100%	Yes

Notes:

Measurement	Time Period	Completeness Target	Site Completeness				Target Met? (Y/N)
			Jul	Aug	Sep	Q3 2025	

[1] USEPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume II: Ambient Air Quality Monitoring Program, recommends three consecutive response concentrations be within +/- 15% of the audit concentration for quarterly audits. For bi-weekly QC checks acceptable monitor responses are +/-15.1% for NO_2 and 7.1% for O_3. The data completeness target for NO_2 is ≥75%; there is no data completeness target for NO or NO_x. For O_3, the data completeness target is met for a 3-year period with an average of 90% of daily maximum 8-hour averages available for a 3-year ozone season period. In Colorado, the Ozone season is January through December (https://aqs.epa.gov/aqsweb/documents/codetables/ozone_seasons.html).

[2] Table 0-9, USEPA Quality Assurance Handbook for Air Pollution Measurement Systems (Volume IV: Meteorological Measurements, Version 2.0).

[3] Table 0-10, USEPA Quality Assurance Handbook for Air Pollution Measurement Systems (Volume IV: Meteorological Measurements, Version 2.0). Temperature is measured at 2 meters above ground level.

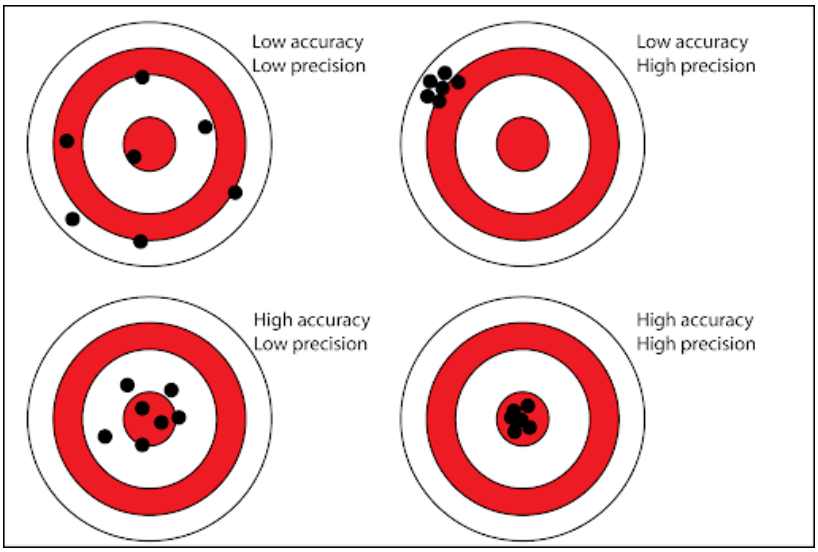


Figure 2. Graphical Representation of Accuracy and Precision

Table 6. 2nd Quarter 2025 Accuracy and Precision

Measurement	Target Accuracy	Target Precision	Q2 2025 Calibration Results[1]
Missile Site Park			
$NO_x/NO/NO_2$	±15%	±15.1%	PASS
O_3	±15%	±7.1%	PASS
Wind Direction	±5°	±5°	PASS
Wind Speed	±0.2 m/s	±0.2 m/s	PASS
Temperature	±0.5 °C	±0.5 °C	PASS
Delta Temperature	±0.1 °C	±0.1 °C	PASS
Relative Humidity	±7%	±7%	PASS
Solar Radiation	±5%	±5%	PASS
Barometric Pressure	±2.25 mm Hg	±2.25 mm Hg	PASS
Precipitation	±10%	±10%	PASS
Hereford			
O_3	±15%	±7.1%	PASS
Wind Direction	±5°	±5°	PASS
Wind Speed	±0.2 m/s	±0.2 m/s	PASS
Temperature	±0.5 °C	±0.5 °C	PASS
Delta Temperature	±0.1 °C	±0.1 °C	PASS
Relative Humidity	±7%	±7%	PASS
Solar Radiation	±5%	±5%	PASS
Barometric Pressure	±2.25 mm Hg	±2.25 mm Hg	PASS
Precipitation	±10%	±10%	PASS
Orchard			
O_3	±15%	±7.1%	PASS
Wind Direction	±5°	±5°	PASS
Wind Speed	±0.2 m/s	±0.2 m/s	PASS
Temperature	±0.5 °C	±0.5 °C	PASS
Delta Temperature	±0.1 °C	±0.1 °C	PASS
Relative Humidity	±7%	±7%	PASS
Solar Radiation	±5%	±5%	PASS
Barometric Pressure	±2.25 mm Hg	±2.25 mm Hg	PASS
Precipitation	±10%	±10%	PASS

Notes:

[1] Results of calibrations are found in Appendix A of the Q2 2025 report.

5. AIR QUALITY DATA SUMMARY

Air quality data collected includes O_3 at all three stations and $NO/NO_2/NO_x$ at the MSP station. In addition, wet deposition and gaseous ammonia are measured in accordance with the National Atmospheric Deposition Program (NADP) standard operating procedures at MSP and Orchard. Q3 2025 wet deposition and gaseous ammonia data from NADP are not yet available. When Q3 2025 wet deposition and gaseous ammonia data are available a separate memorandum will be issued. This section summarizes the O_3 and NO_2 data collected during Q3 2025.

5.1 Gaseous O_3 Data Summary

O_3 data collected for Q3 2025 at all three stations was compared to the 2008 O_3 AAQS (0.075 ppm) and 2015 ozone AAQS (0.070 ppm). Both the 2008 and 2015 ozone AAQS are based on the fourth highest daily maximum 8-hour ozone concentration averaged over 3 years. During Q3 2025, the daily maximum 8-hour ozone concentrations measured at MSP, Hereford and Orchard stations were below both the 2008 and the 2015 AAQS. The four highest year-to-date daily maximum 8-hour average ozone concentrations at all three stations for 2025 are presented in **Table 7**. **Table 8** shows the 3-year average of the fourth highest daily maximum 8-hour average ozone concentrations at each site for historical data and for 2025 year-to-date. Values are color-coded according to the AAQS values; yellow indicates values above only the 2015 AAQS value, while orange indicates value above both the 2015 and 2008 AAQS values. The rolling 8-hour average ozone concentrations at MSP, Hereford, and Orchard are presented in **Figure 3**, **Figure 4**, and **Figure 5**, respectively. Comparison to the AAQS standard for the full year of monitoring data collected in 2025 will be done as part of the 2025 annual report.

5.1.1 MSP Year-to-Date O_3 Data Summary

At MSP, measured daily maximum 8-hour ozone concentrations remained below the 2008 standard, and exceeded the 2015 standard once on June 15th.

5.1.2 Hereford Year-to-Date O_3 Data Summary

At Hereford, measured daily maximum 8-hour ozone concentrations remained below the 2008 and 2015 standards.

5.1.3 Orchard Year-to-Date O_3 Data Summary

At Orchard, measured daily maximum 8-hour ozone concentrations remained below the 2008 and 2015 standards.

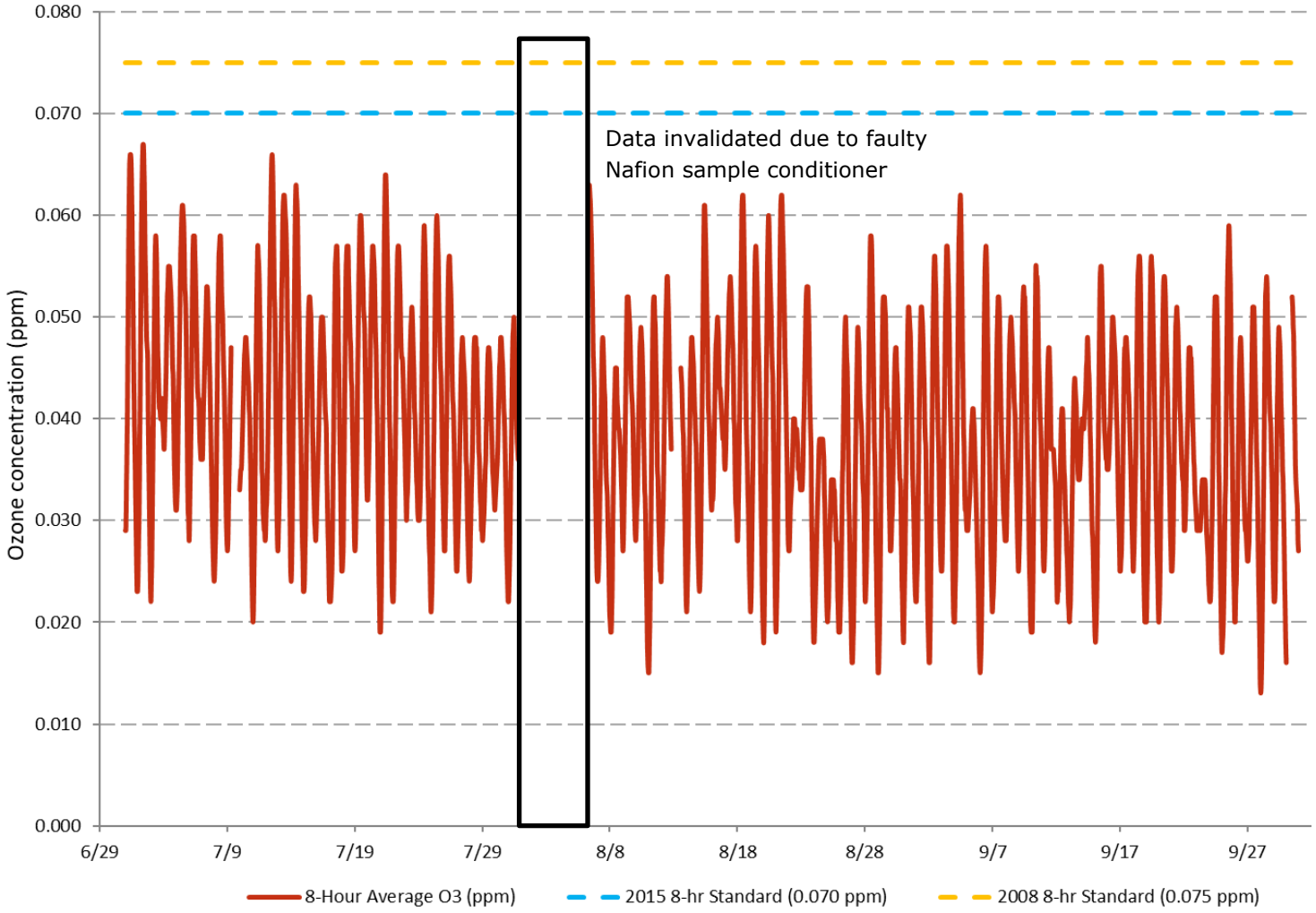


Figure 3. MSP Q3 2025 Rolling 8-hour averaged O_3

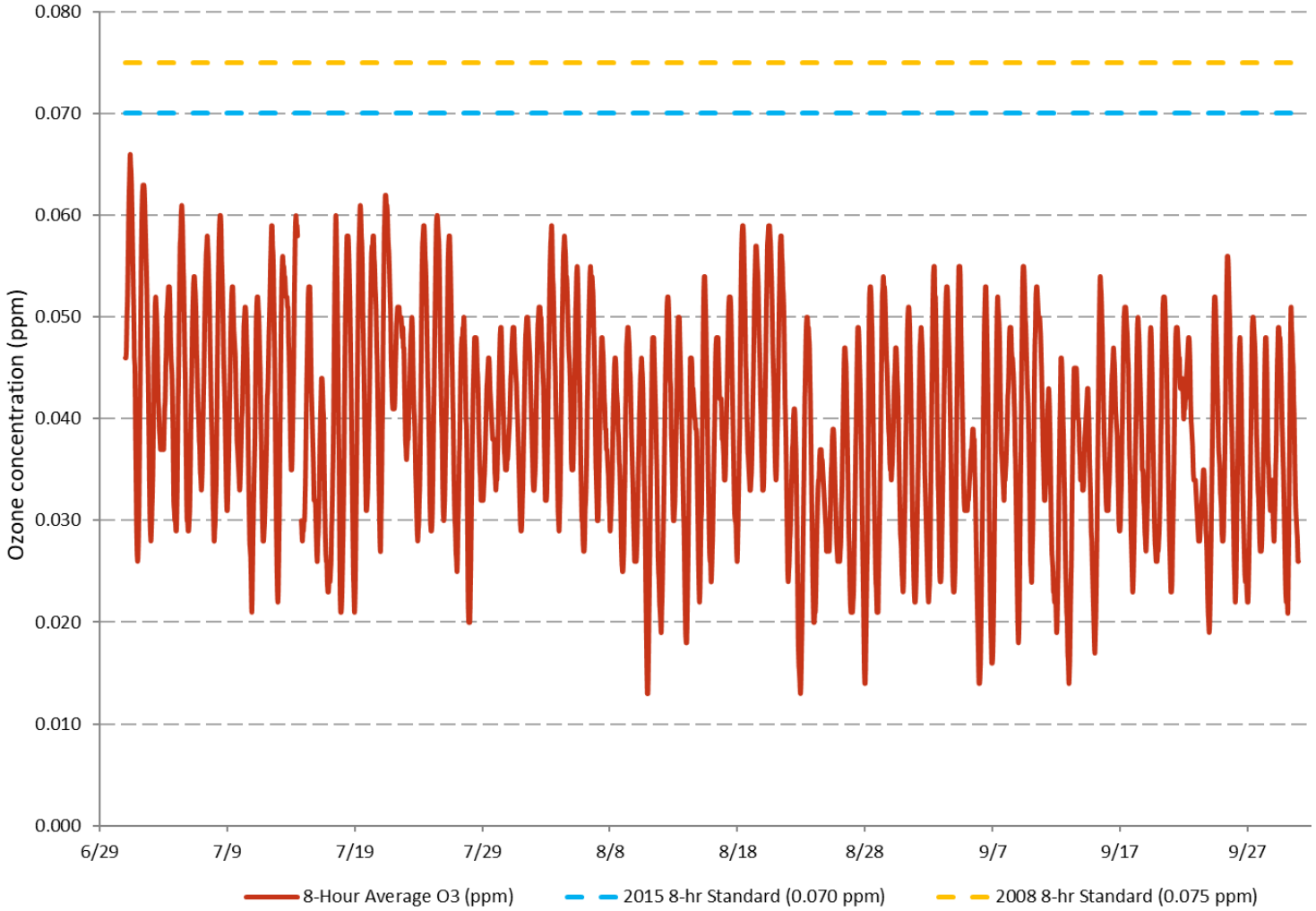


Figure 4. Hereford Q3 2025 Rolling 8-hour averaged O_3

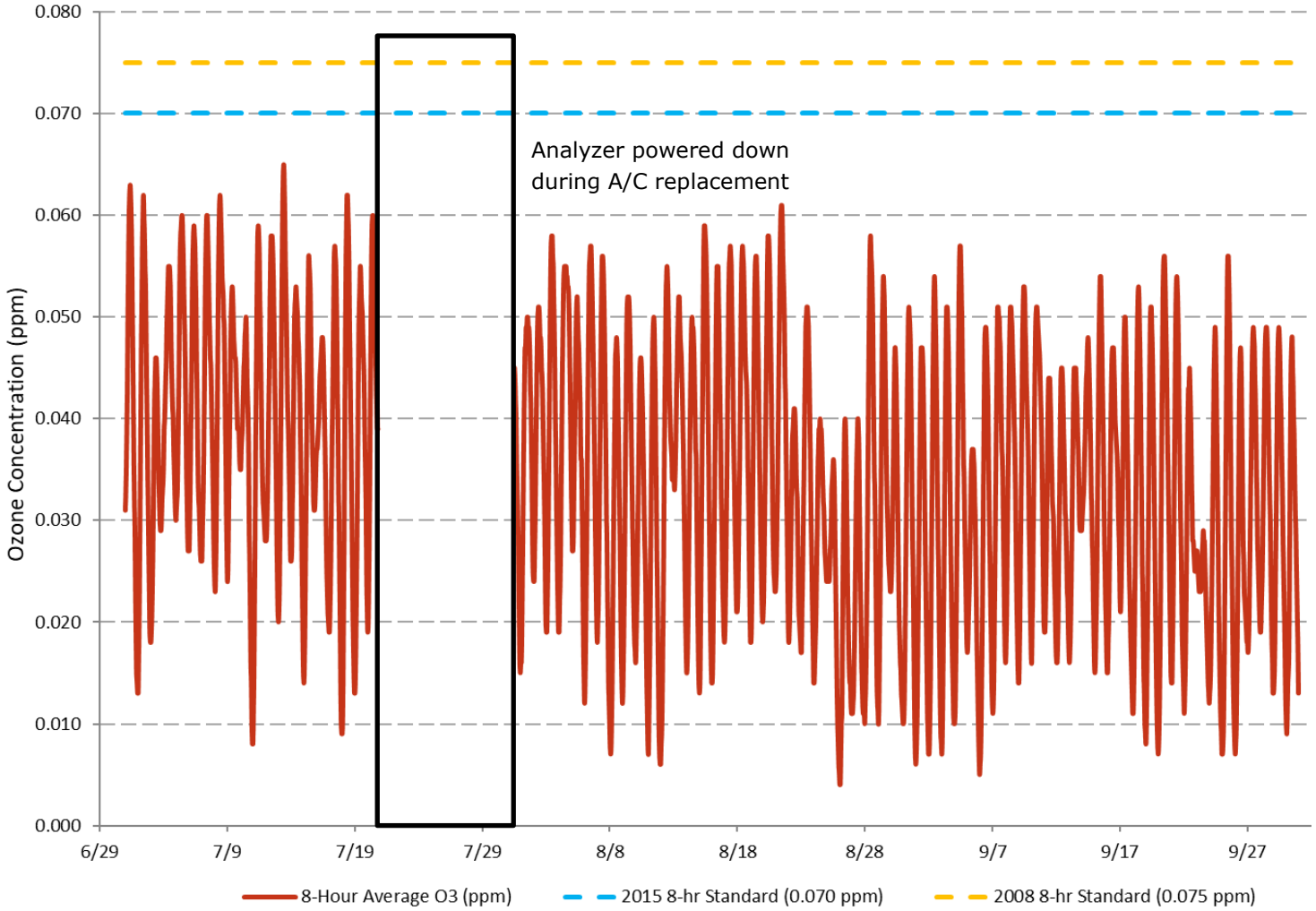


Figure 5. Orchard Q3 2025 Rolling 8-hour averaged O_3

Table 7. Weld County Network Year-to-Date Highest Daily Maximum 8-hour Average O_3

Site Name	1st Max 8-Hour (ppm)	Date 1st Max 8-Hour	2nd Max 8-Hour (ppm)	Date 2nd Max 8-Hour	3rd Max 8-Hour (ppm)	Date 3rd Max 8-Hour	4th Max 8-Hour (ppm)	Date 4th Max 8-Hour	Max 8-Hour Averages Exceeding the 2008 AAQS Value[1]	Max 8-Hour Averages Exceeding the 2015 AAQS Value[1]
MSP	0.071	6/15/2025	0.070	5/10/2025	0.069	6/19/2025	0.068	5/12/2025	0	1
Hereford	0.070	5/10/2025	0.068	4/11/2025	0.067	5/12/2025	0.067	6/19/2025	0	0
Orchard	0.070	6/19/2025	0.067	5/10/2025	0.066	4/9/2025	0.066	5/13/2025	0	0

Notes:
[1] The O_3 AAQS value is based on the 3-year average of the 99th percentile (4th highest) of 8-hour daily maximum concentrations. Comparison with the O_3 AAQS for 2025 will be made at the conclusion of the calendar year.
[2] Orange highlighting indicates that the value is above the 2008 O_3 standard. Yellow highlighting indicates that the value is above the 2015 O_3 standard.

Table 8. Weld County Network Historical and 2025 Year-to-Date Comparison to O_3 AAQS

Year	MSP 4th Max 8-Hour (ppm)	3-Year Average (ppm)	AAQS[1] Exceeded?	Hereford 4th Max 8-Hour (ppm)	3-Year Average (ppm)	AAQS[1] Exceeded?	Orchard 4th Max 8-Hour (ppm)	3-Year Average (ppm)	AAQS[1] Exceeded?
2021	0.079	-	-[2]	0.075	-	-[2]	0.075	-	-[2]
2022	0.073	-	-[2]	0.065	-	-[2]	0.069	-	-[2]
2023	0.069	0.073	Yes	0.063	0.067	No	0.064	0.069	No
2024	0.080	0.074	Yes	0.077	0.068	No	0.072	0.068	No
2025[3]	0.068	0.072	Yes	0.067	0.069	No	0.066	0.067	No

Notes:
[1] The O_3 AAQS value is based on the 3-year average of the 99th percentile (4th highest) of 8-hour daily maximum concentrations. Comparison with the O_3 AAQS for 2025 will be made at the conclusion of the calendar year.
[2] Three years of data are required for computation of the AAQS value and comparison to the standard.
[3] Results for 2025 utilize year-to-date values for the 4th highest 8-hour daily maximum concentrations.
[4] Orange highlighting indicates that the value is above the 2008 O_3 standard. Yellow highlighting indicates that the value is above the 2015 O_3 standard.

5.2 Gaseous NO_2 Data Summary

NO_2 data collected at MSP was compared against the AAQS standard for 1-hour averaged NO_2 (100 ppb). Once a full year of data has been collected, measurements will be compared to the annual standard (53 ppb). The 1-hour average NO_2 standard is based on the 98th percentile of 1-hour averaged daily maximum concentrations, averaged over 3-years. The daily maximum 1-hour average concentration in Q3 2025 was 16.4 ppb, recorded on September 30th at 6:00 Mountain Standard Time. A timeseries of hourly NO_2 data collected in Q3 2025 is presented in **Figure 6**. A summary of NO_2 data collected year-to-date is presented in **Table 9** and **Table 10**.

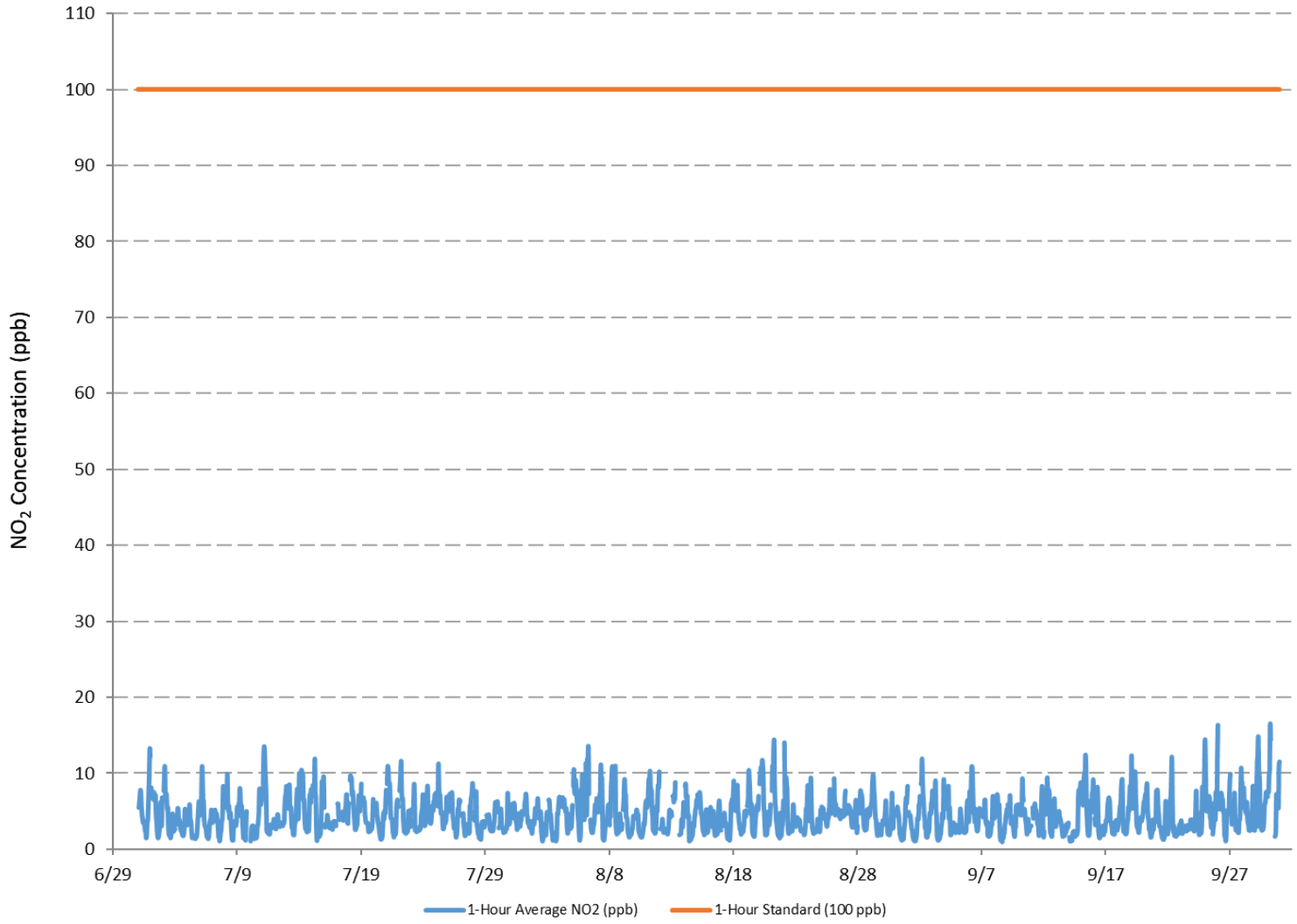


Figure 6. MSP Q3 2025 1-Hour Averaged NO_2

Table 9. MSP Year-to-Date Highest Daily Maximum 1-Hour Average NO_2

Period	1st Maximum	2nd Maximum	3rd Maximum	4th Maximum	5th Maximum	6th Maximum	7th Maximum	8th Maximum	Max 1-Hour Averages Exceeding the AAQS Value[1]
2021 NO_2 (ppb)	69.0	43.2	39.9	39.6	38.7	38.3	37.1	36.8	0
2022 NO_2 (ppb)	67.2	63.4	62.0	58.0	57.4	56.9	54.5	54.5	0
2023 NO_2 (ppb)	64.9	58.3	52.4	51.7	51.5	51.2	50.2	49.4	0
2024 NO_2 (ppb)	45.8	44.2	41.4	37.6	36.0	35.4	35.3	35.1	0
2025 NO_2 (ppb) [2]	42.9	41.9	38.7	38.4	37.6	36.6	35.7	35.5	0

Notes:

[1] The 1-hour NO_2 AAQS standard is based on the 3-year average of the 98th percentile (8th highest) of 1-hour daily maximum concentrations. Comparison with the 1-hour AAQS standard (100 ppb) for 2025 will be made at the conclusion of the calendar year.

[2] Values for 2025 represent year-to-date highest daily 1-hour maximum concentrations.

Table 10. MSP Year-to-Date 1-Hour NO_2 Quarterly and Annual Averages

Period	Q1 Quarterly Average	Q2 Quarterly Average	Q3 Quarterly Average	Q4 Quarterly Average	Annual Mean	Annual AAQS Design Value[1] Exceeded?
2021 NO_2 (ppb)	9.5	4.8	6.2	9.6	7.5	No
2022 NO_2 (ppb)	13.6	4.3	5.7	10.3	8.5	No
2023 NO_2 (ppb)	13.4	4.8	4.8	9.7	8.0	No
2024 NO_2 (ppb)	8.6	3.9	5.2	9.1[2]	6.5	No
2025 NO_2 (ppb)	7.7	4.0	4.4	-	-	-[3]

Notes:

[1] The annual NO_2 standard is based on the annual mean of 1-hour average NO_2 concentrations.

[2] Quarter did not meet data completeness requirements.

[3] Insufficient data is available to calculate the value. Comparison with the annual AAQS standard (53 ppb) for 2025 will be made at the conclusion of the calendar year.

6. METEOROLOGICAL DATA SUMMARY

This section summarizes the meteorological data collected during Q3 2025.

6.1 Wind Data Summary

The Q3 2025 average wind speed at the three stations at 10-m above ground level (agl) was 2.8 meters per second (m/s), 3.9 m/s, and 3.1 m/s at MSP, Hereford, and Orchard, respectively. The maximum hourly average wind speed for Q3 2025 was 10.6 m/s at MSP, 14.7 m/s at Hereford, and 10.5 m/s at Orchard. **Figure 7** through **Figure 9** present wind rose plots for each station during Q3 2025. These wind roses are a graphical representation of how the wind speed and direction were distributed for Q3 2025. On each wind rose, the bars at 0 degrees (°) correspond to wind coming from the North and the bars at 180° correspond to wind coming from the South. The size of each bar is an indication of how frequently the wind comes from a particular direction. The color of the bars represents the corresponding wind speed when the wind was blowing from a particular direction. Each station had a unique wind profile during Q3 2025. At the MSP station, wind direction did not have a strong directional trend and came more or less equally from all directions, with a slightly higher frequency of southeasterly and a slightly lower frequency of southwesterly winds. The strongest winds can be observed from all directions. At the Hereford station, winds mostly came from the north/northwest and south. The fastest winds came from the north. At the Orchard station, winds mostly came from the east and west, and were the strongest from all directions except west. Monthly average hourly and maximum wind speeds per month at each station are listed in **Table 11** along with all other measured meteorological parameters.

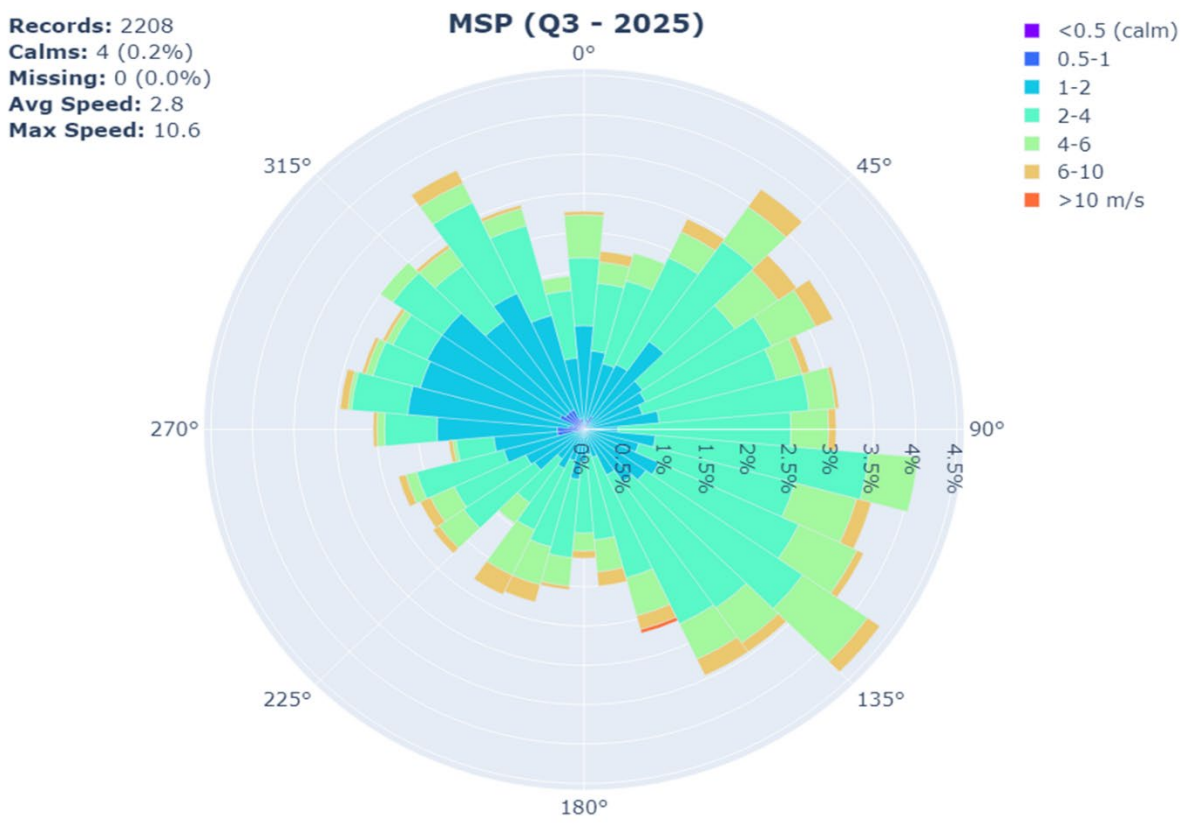


Figure 7. MSP Q3 2025 Wind Rose

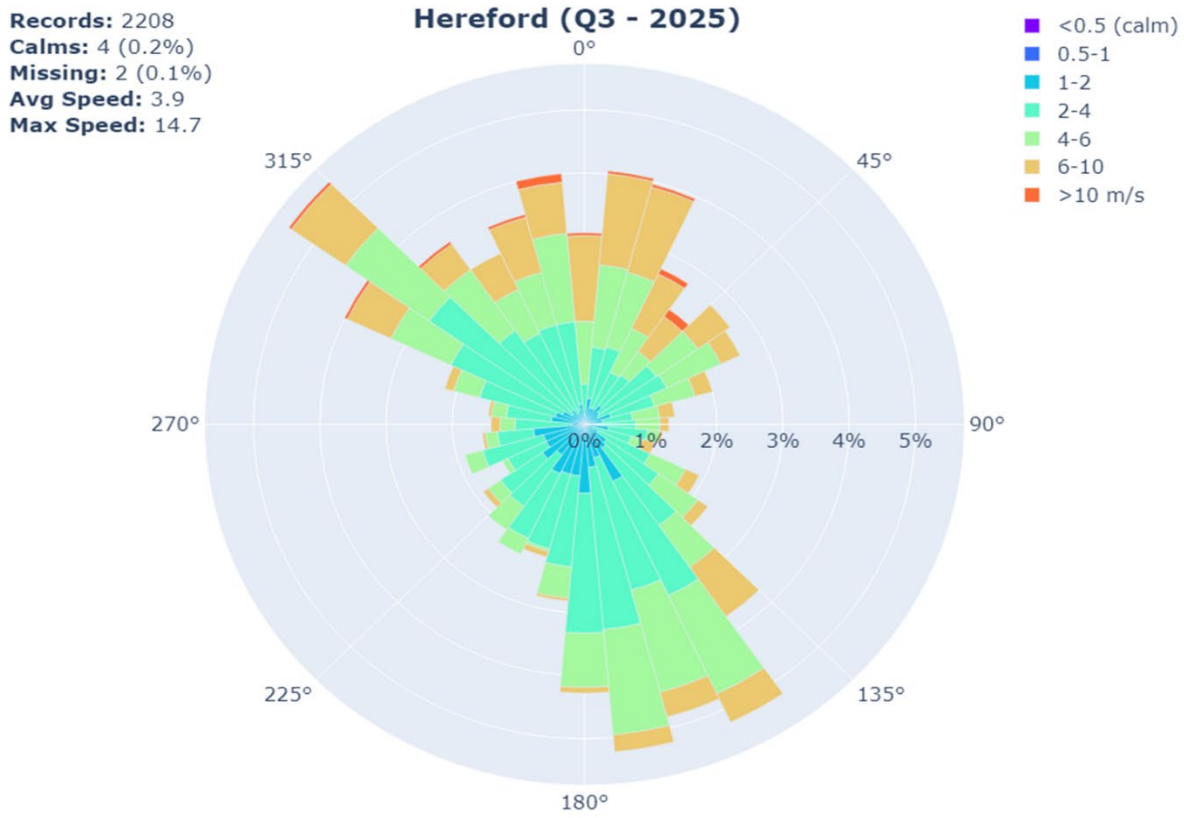


Figure 8. Hereford Q3 2025 Wind Rose

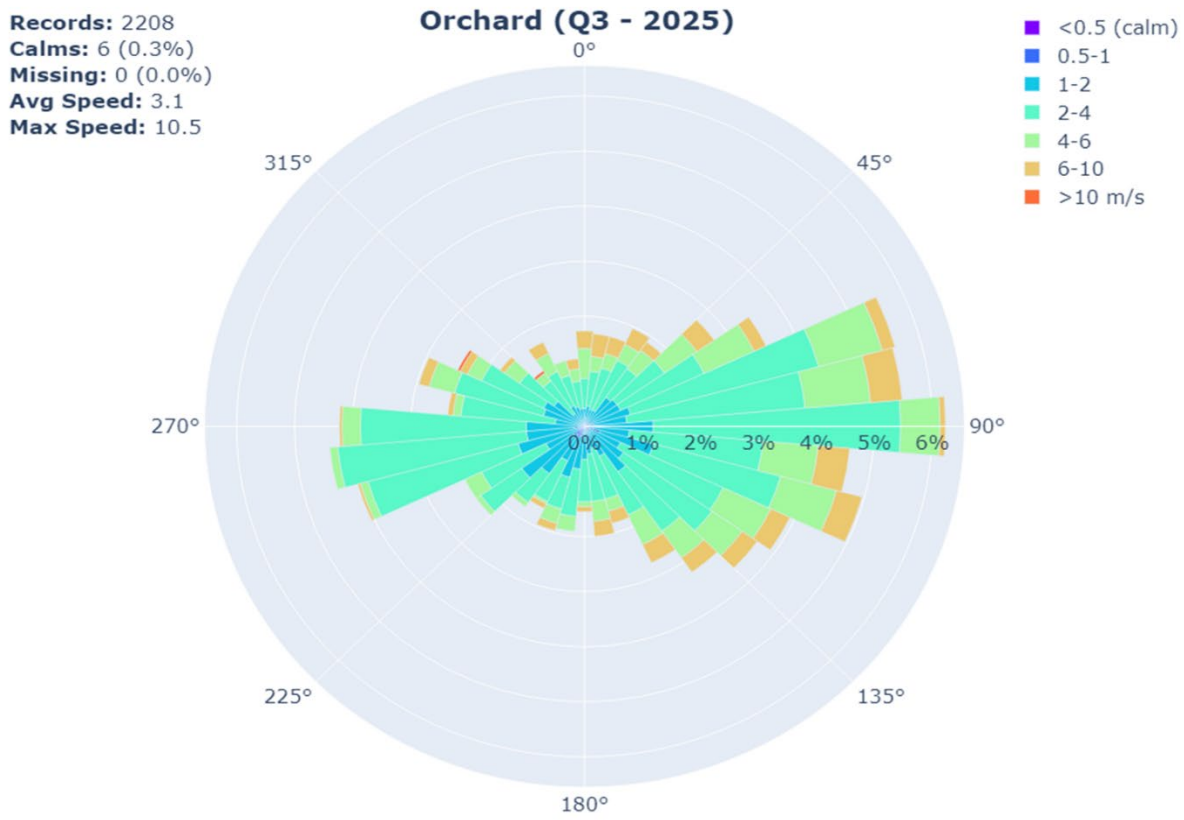


Figure 9. Orchard Q3 2025 Wind Rose

Table 11. Q3 2025 Meteorological Data Summary

Parameter	Units	Form	July	August	September
Missile Site Park					
2-M Temperature	°C	Monthly Average	23.8	22.4	18.2
		Maximum Hourly Average	38.1	37.6	32.3
		Minimum Hourly Average	13.1	11.3	7.1
10-M Temperature	°C	Monthly Average	23.5	22.2	18.2
		Maximum Hourly Average	36.8	36.2	31.1
		Minimum Hourly Average	13.6	11.3	7.7
Delta Temperature	°C	Monthly Average	-0.2	-0.2	0.1
		Maximum Hourly Average	2.3	2.0	2.6
		Minimum Hourly Average	-2.1	-2.3	-1.8
10-M Horizontal Wind Speed	m/s	Monthly Average	3.0	2.7	2.5
		Maximum Hourly Average	10.6	9.4	8.8
2-M Relative Humidity	Percent	Monthly Average	53.0	57.5	58.2
		Maximum Hourly Average	100.0	100.0	99.7
Station Barometric Pressure	mm Hg	Monthly Average	637.5	638.8	638.0
		Maximum Hourly Average	643.2	643.8	644.5
Station Precipitation	in	Monthly Total	1.243	2.585	2.200
	in/hr	Maximum Hourly Total	0.772	0.800	0.189
2-M Solar Radiation	W/m^2	Monthly Average	295	247	204
		Maximum Hourly Average	1105	1024	879
Hereford					
2-M Temperature	°C	Monthly Average	22.2	20.5	16.6
		Maximum Hourly Average	37.4	34.4	31.8
		Minimum Hourly Average	10.0	9.0	3.0

Parameter	Units	Form	July	August	September
10-M Temperature	°C	Monthly Average	22.1	20.5	16.9
		Maximum Hourly Average	35.7	33.7	30.4
		Minimum Hourly Average	11.8	9.7	4.7
Delta Temperature	°C	Monthly Average	-0.1	0.1	0.2
		Maximum Hourly Average	4.8	5.3	4.3
		Minimum Hourly Average	-2.2	-2.2	-2.0
10-M Horizontal Wind Speed	m/s	Monthly Average	4.1	3.8	3.9
		Maximum Hourly Average	14.7	11.4	10.7
2-M Relative Humidity	Percent	Monthly Average	57.7	63.7	61.4
		Maximum Hourly Average	100.0	100.0	99.0
Station Barometric Pressure	mm Hg	Monthly Average	629.8	631.0	629.9
		Maximum Hourly Average	635.3	635.7	636.1
Station Precipitation	in	Monthly Total	4.381	1.159	3.014
	in/hr	Maximum Hourly Total	0.591	0.382	0.410
2-M Solar Radiation	W/m^2	Monthly Average	275	244	209
		Maximum Hourly Average	1054	981	900
Orchard					
2-M Temperature	°C	Monthly Average	23.4	21.5	17.4
		Maximum Hourly Average	40.1	38.5	33.6
		Minimum Hourly Average	9.8	8.7	2.3
10-M Temperature	°C	Monthly Average	23.6	21.9	18.0
		Maximum Hourly Average	38.4	37.3	32.1
		Minimum Hourly Average	12.1	9.9	4.3
Delta Temperature	°C	Monthly Average	0.2	0.4	0.6
		Maximum Hourly Average	5.2	6.7	5.0
		Minimum Hourly Average	-2.2	-2.0	-1.7

Parameter	Units	Form	July	August	September
10-M Horizontal Wind Speed	m/s	Monthly Average	3.3	3.1	2.9
		Maximum Hourly Average	10.5	10.5	9.6
2-M Relative Humidity	Percent	Monthly Average	60.3	66.2	66.4
		Maximum Hourly Average	99.8	100.0	100.0
Station Barometric Pressure	mm Hg	Monthly Average	648.9	650.2	649.5
		Maximum Hourly Average	654.9	655.4	656.4
Station Precipitation	in	Monthly Total	3.992	3.303	1.797
	in/hr	Maximum Hourly Total	1.848	1.466	0.229
2-M Solar Radiation	W/m^2	Monthly Average	297	256	217
		Maximum Hourly Average	1068	976	911

Notes:
[1]There are small differences in precision relative to the finalized valid data due to rounding.

6.2 Precipitation Data Summary

Hourly precipitation data was collected at all three stations with a tipping bucket sensor at 1-m agl. July had the highest total monthly precipitation at Hereford and Orchard, while August saw the highest monthly total at MSP. Maximum hourly precipitation occurred in August at MSP, and July at Hereford and Orchard. A summary of total monthly and maximum hourly precipitation for Q3 2025 at all three stations is presented in **Figure 10** through **Figure 12** and in **Table 11**.

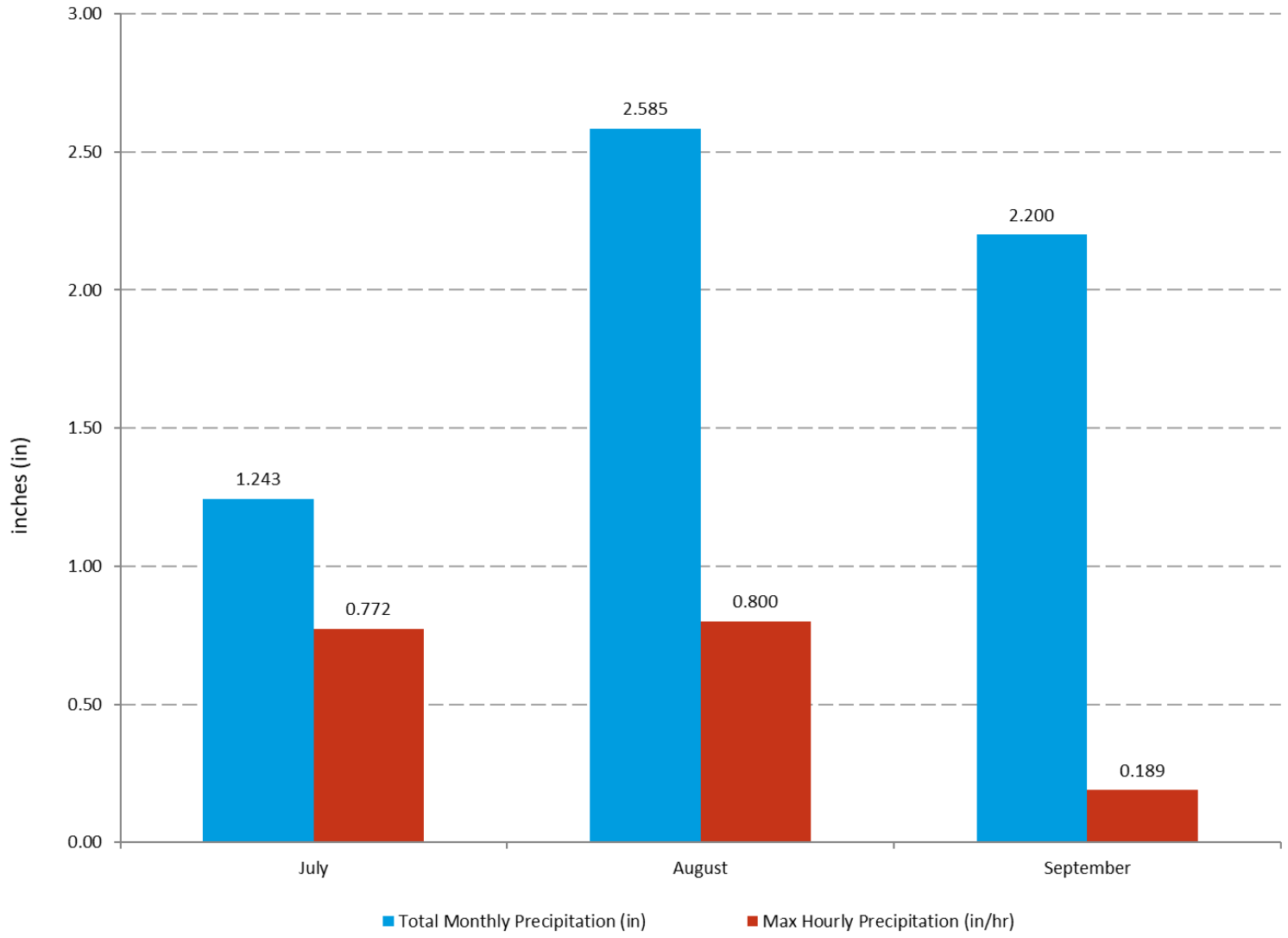


Figure 10. MSP Q3 2025 Precipitation Summary

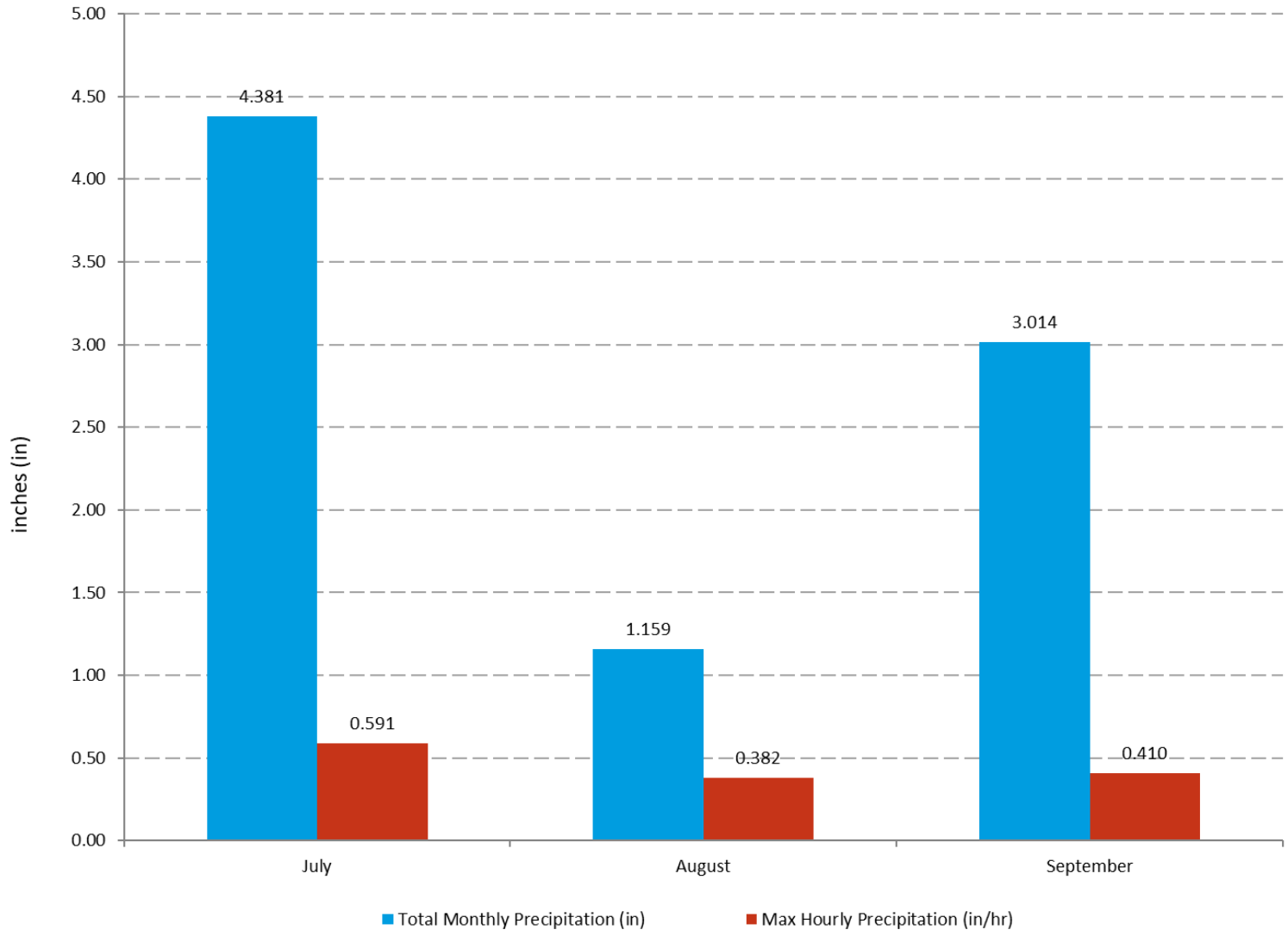


Figure 11. Hereford Q3 2025 Precipitation Summary

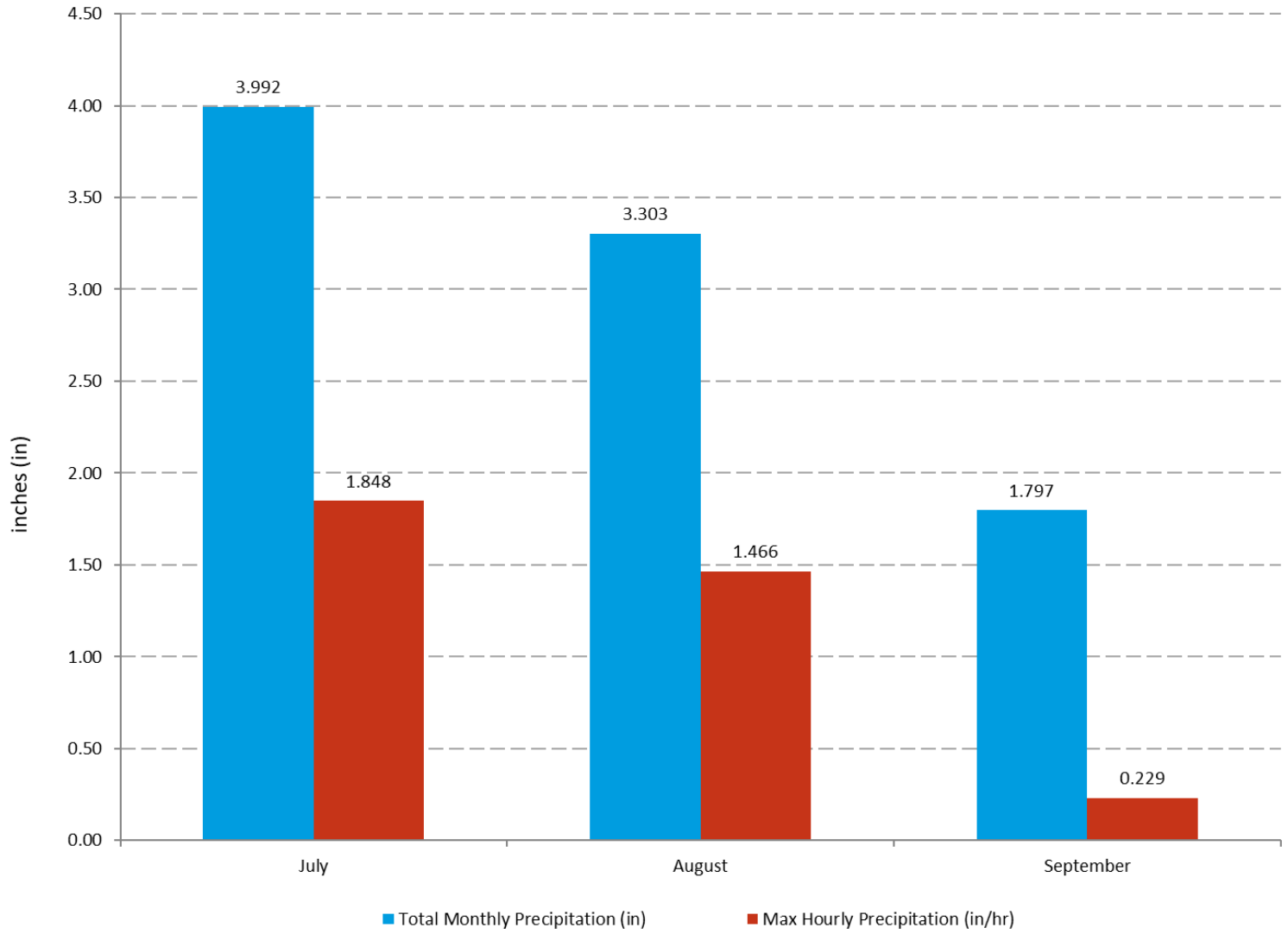


Figure 12. Orchard Q3 2025 Precipitation Summary

6.3 Temperature Data Summary

Temperature data was collected at all three stations at heights of 2-m and 10-m agl. The highest temperatures occurred in July for 2-m and 10-m agl at all three stations. The lowest temperatures occurred in September for 2-m and 10-m agl at all three stations. A summary of monthly average and hourly maximum and minimum temperatures (for both 2-m and 10-m probes) for Q3 2025 at all three stations is presented in **Figure 13** through **Figure 18** and **Table 11**.

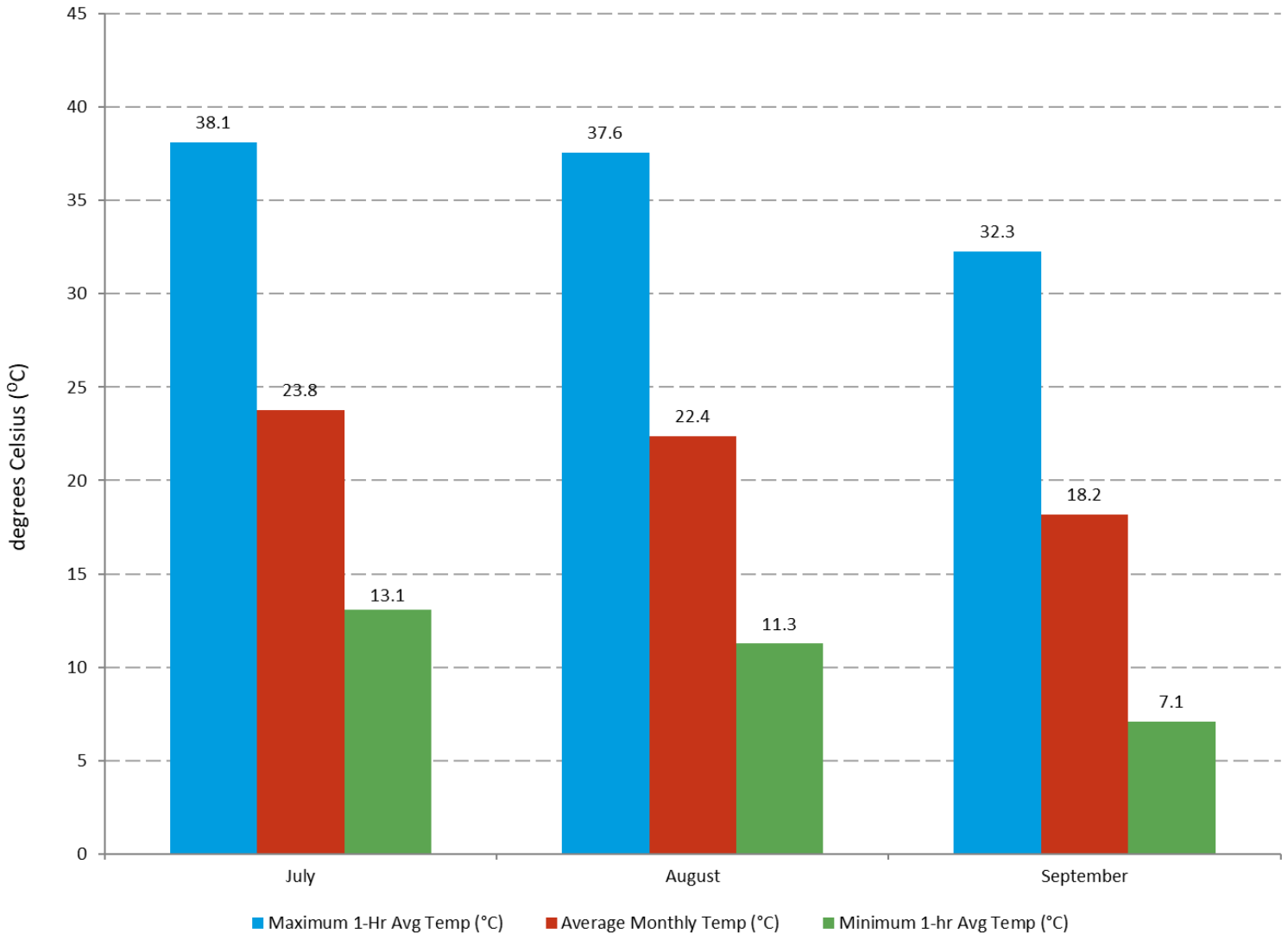


Figure 13. MSP Q3 2025 2-Meter Temperature Summary

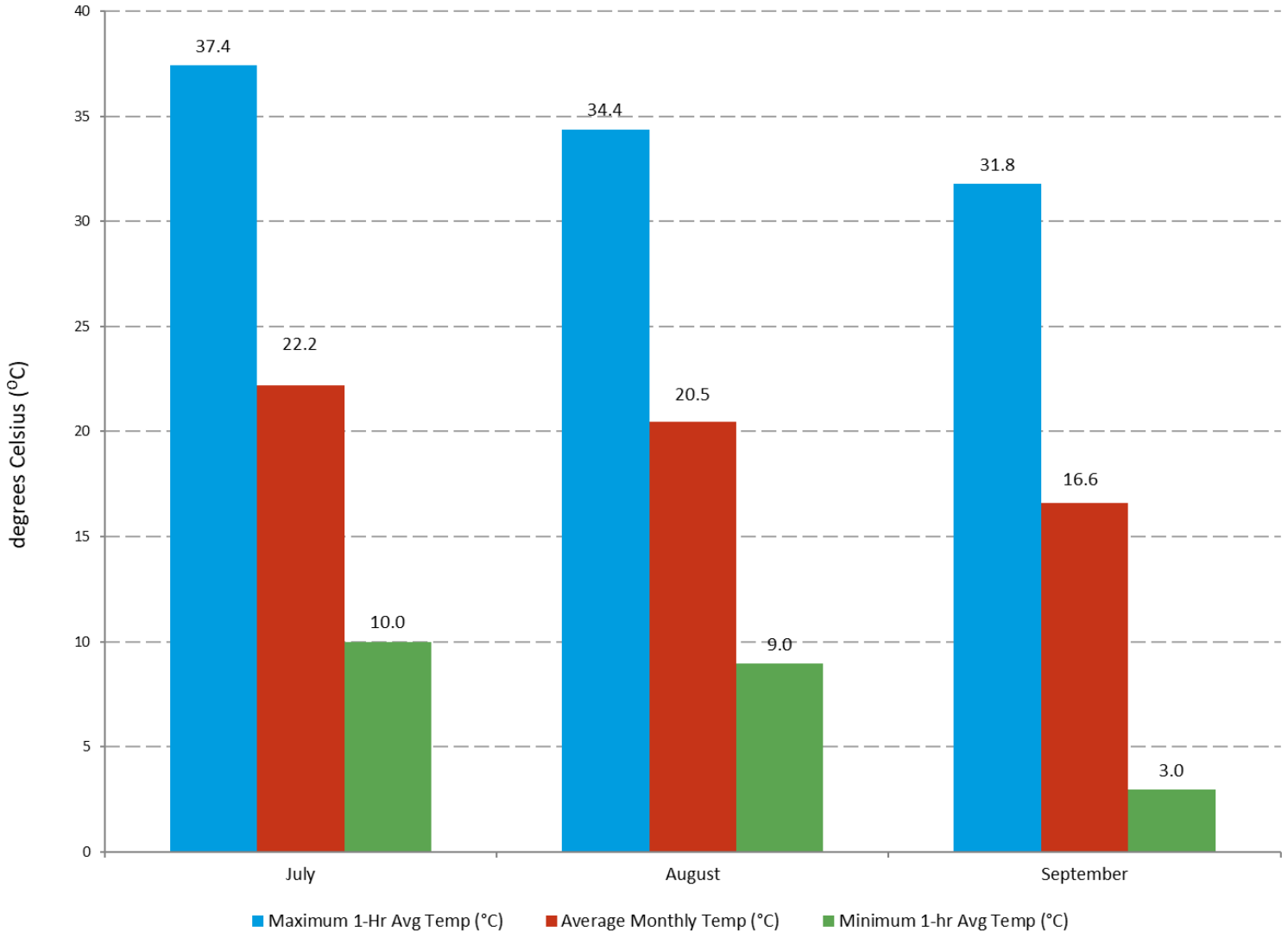


Figure 14. Hereford Q3 2025 2-Meter Temperature Summary

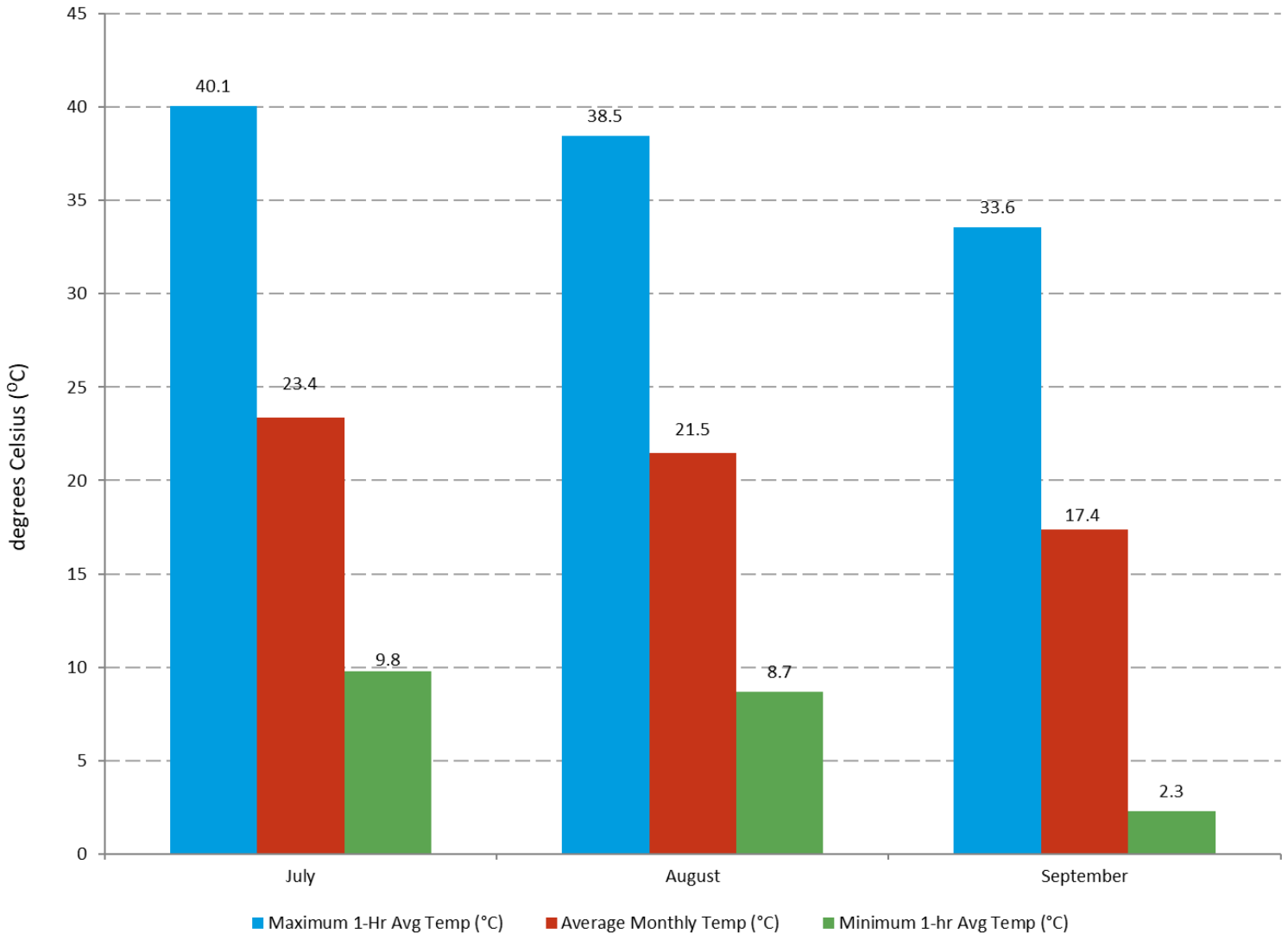


Figure 15. Orchard Q3 2025 2-Meter Temperature Summary

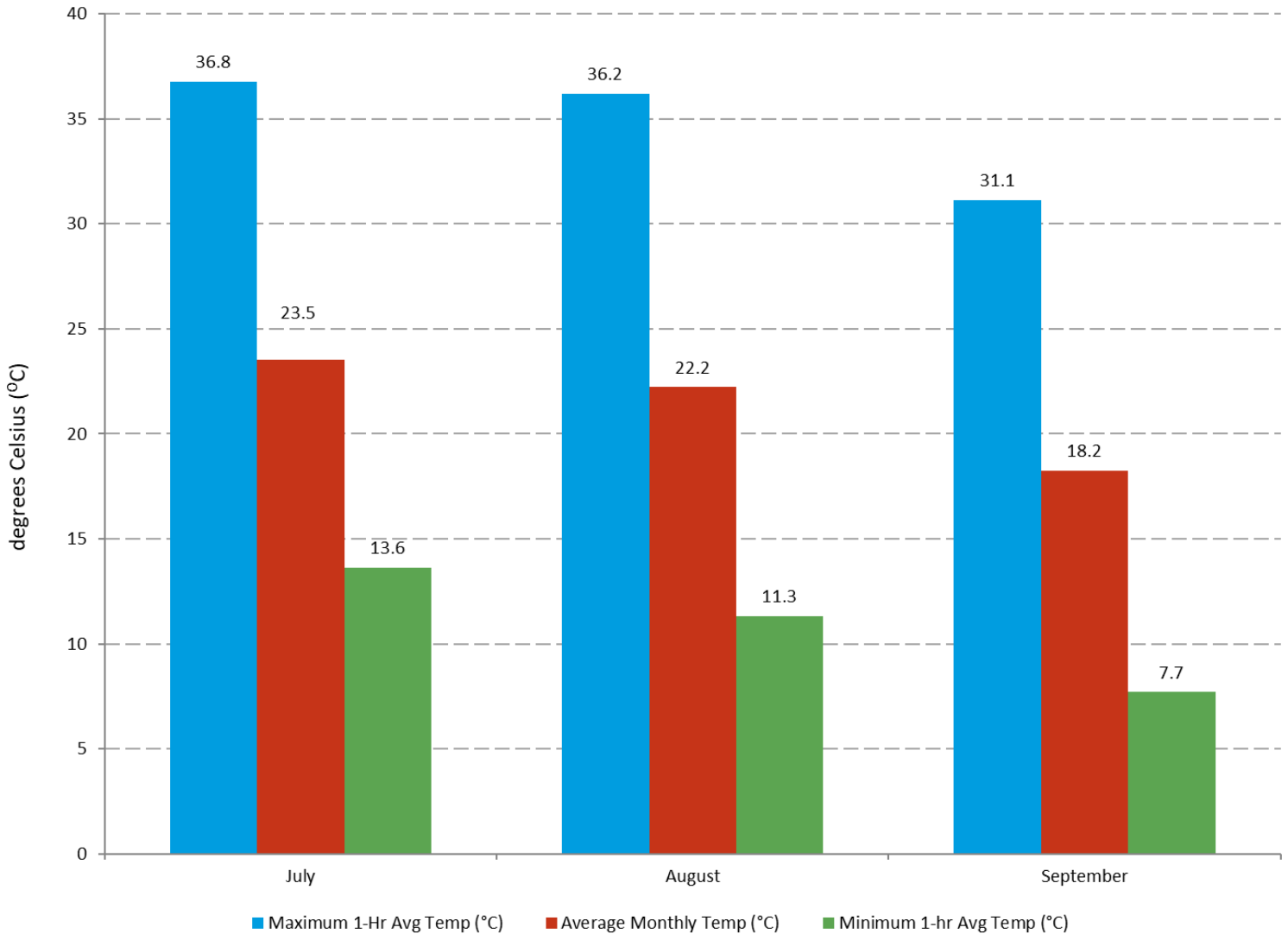


Figure 16. MSP Q3 2025 10-Meter Temperature Summary

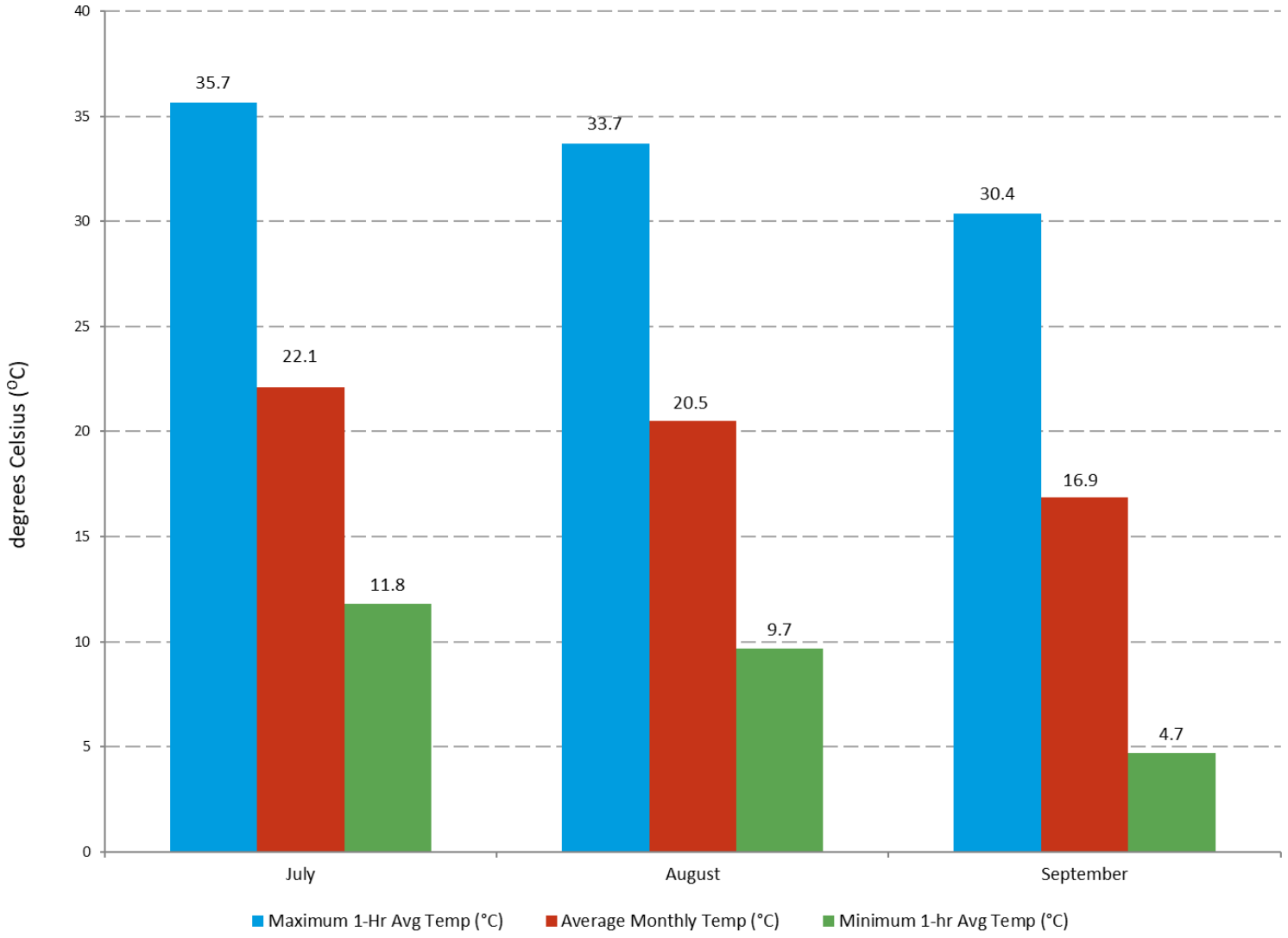


Figure 17. Hereford Q3 2025 10-Meter Temperature Summary

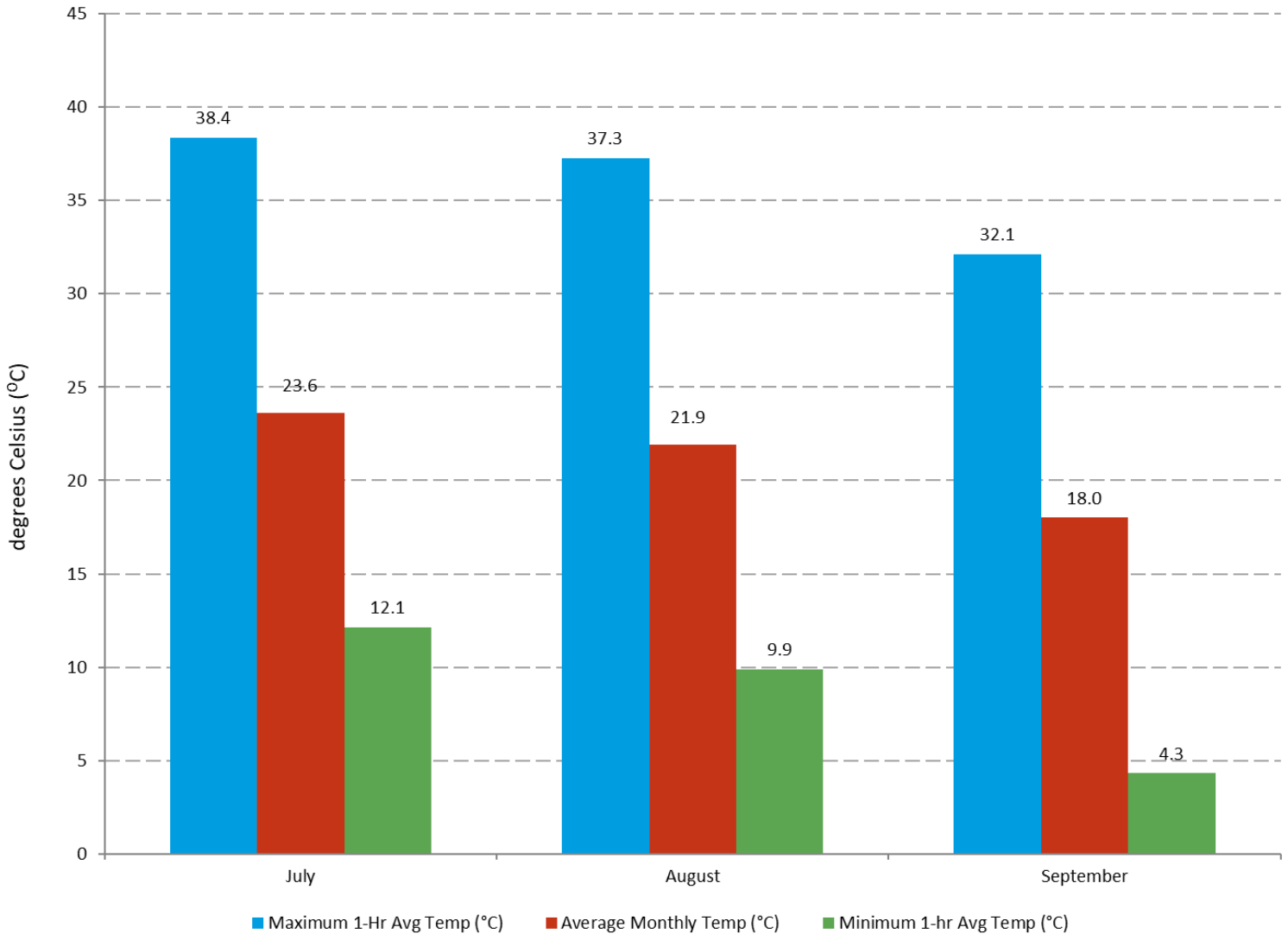


Figure 18. Orchard Q3 2025 10-Meter Temperature Summary

6.4 Delta Temperature Data Summary

Delta temperature is a calculated measurement made by subtracting the 2-m temperature probe reading from the 10-m temperature probe reading (10-m – 2-m). It is an indicator of atmospheric stability and is important for modeling purposes. The two most isolated stations (Hereford and Orchard) exhibited the largest positive delta temperature extremes compared to the more 'urban' station of MSP. A summary of monthly average and hourly maximum and minimum delta temperature for Q3 2025 at all three stations is presented in **Figure 19** through **Figure 21** and **Table 11**.

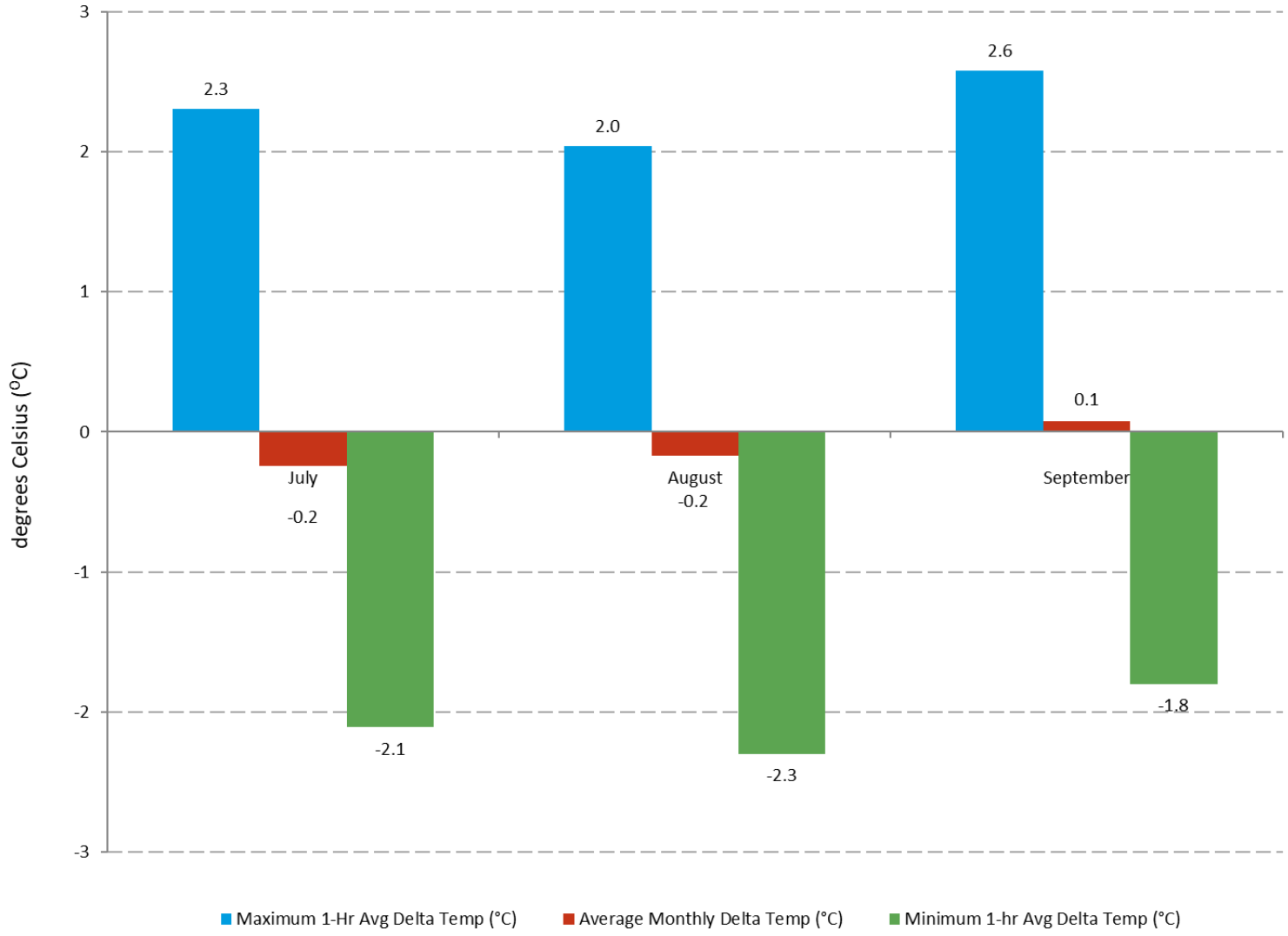


Figure 19. MSP Q3 2025 Delta Temperature Summary

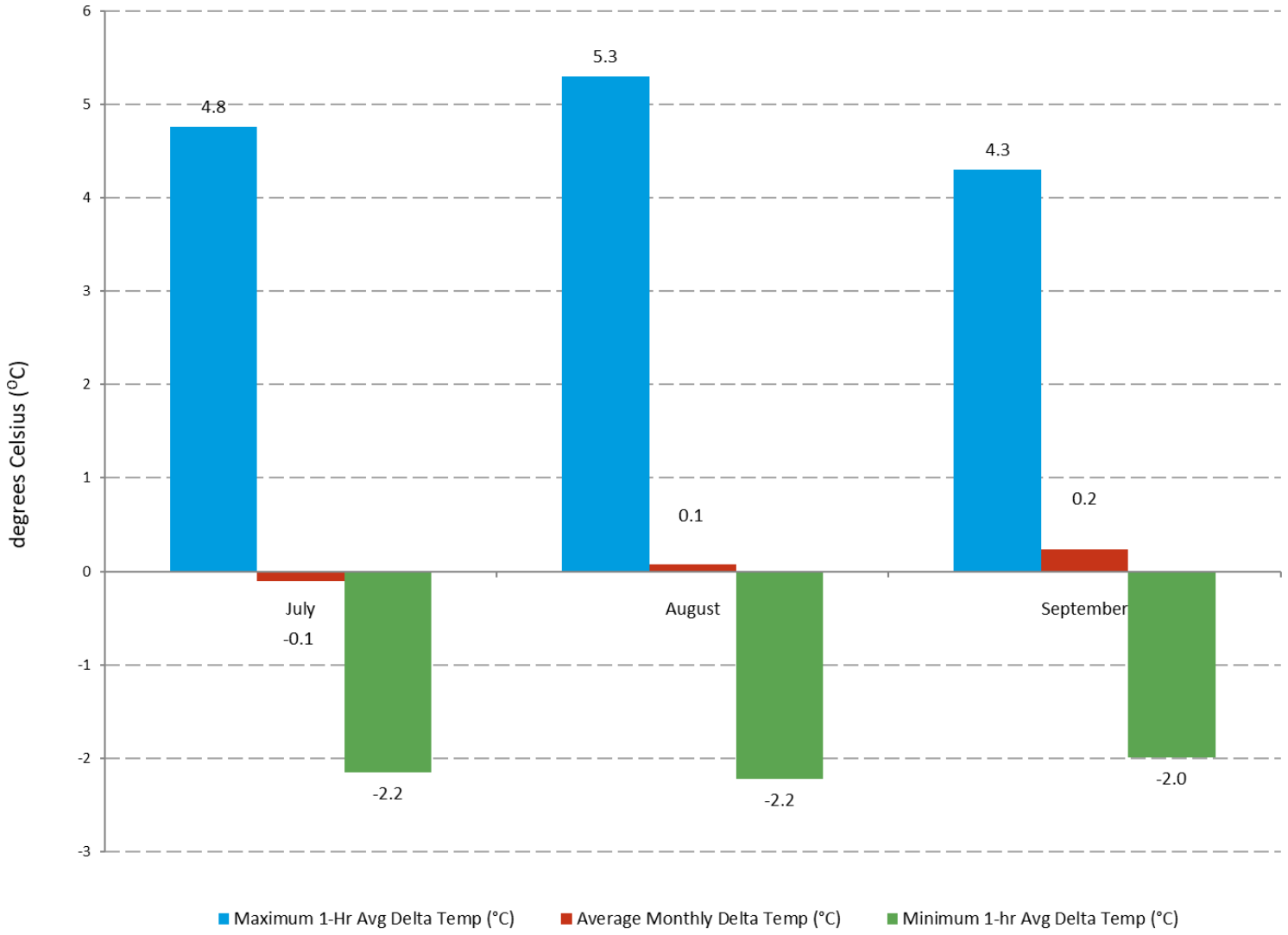


Figure 20. Hereford Q3 2025 Delta Temperature Summary

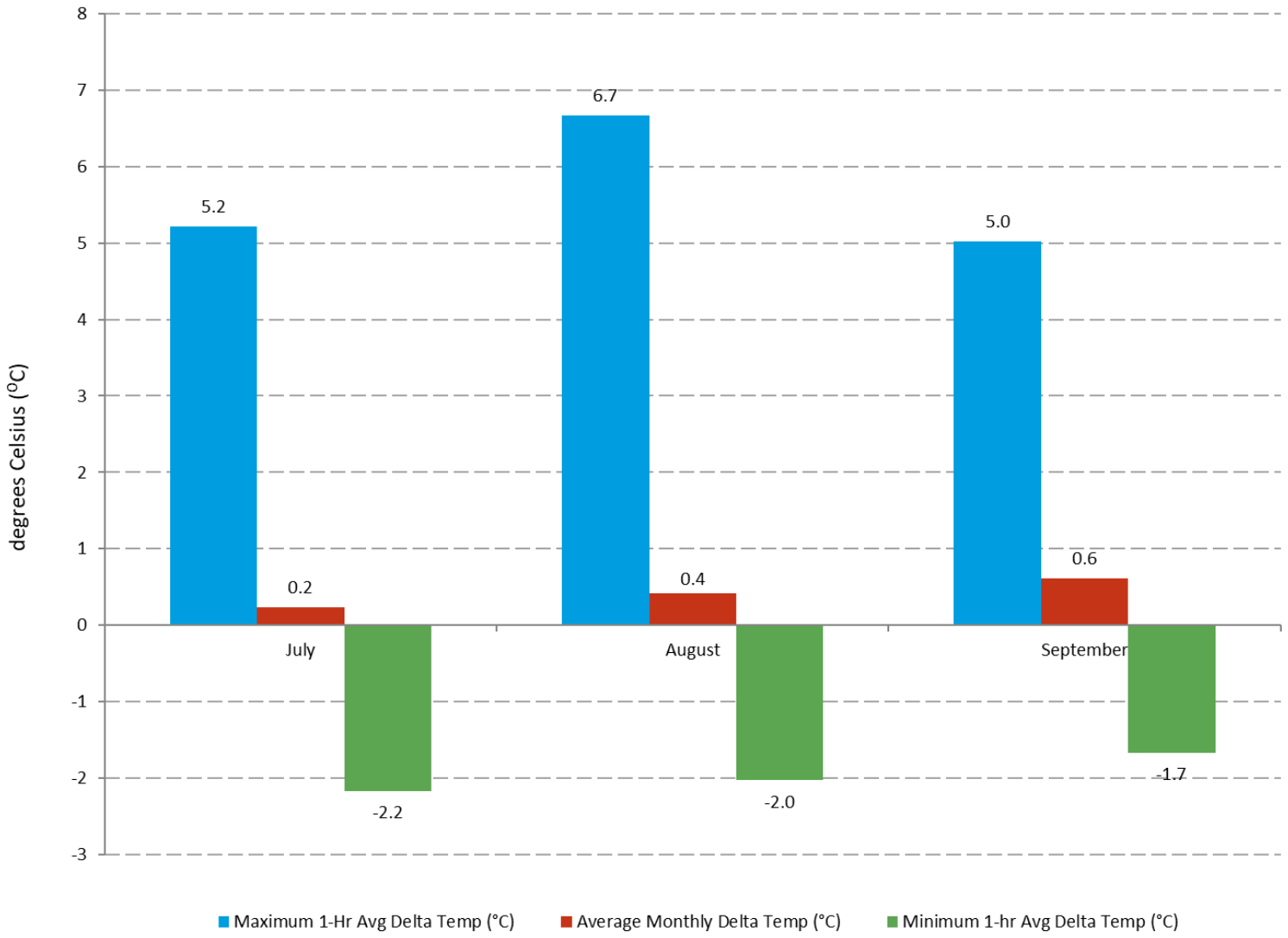


Figure 21. Orchard Q3 2025 Delta Temperature Summary

6.5 Barometric Pressure Data Summary

Barometric pressure data is collected using a barometric pressure sensor located inside each station shelter. The average monthly barometric pressure at each station was correlated with the elevation at each location, with the highest elevation station having the lowest monthly average barometric pressure (Hereford) and the lowest elevation station having the highest monthly average barometric pressure (Orchard). Maximum hourly average and monthly average barometric pressures for Q3 2025 at all three stations are summarized in **Figure 22** through **Figure 24** and **Table 11**.

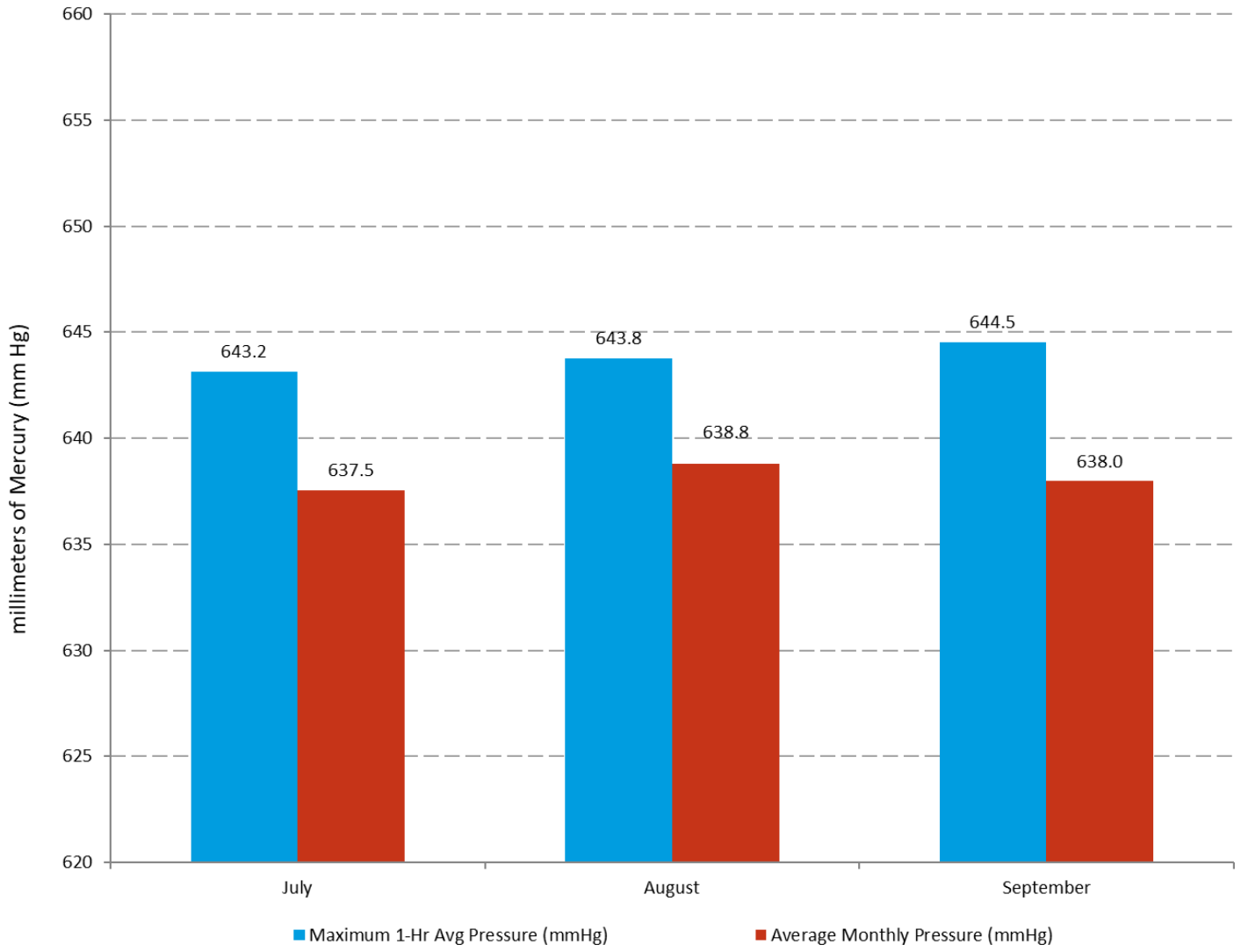


Figure 22. MSP Q3 2025 Barometric Pressure Summary

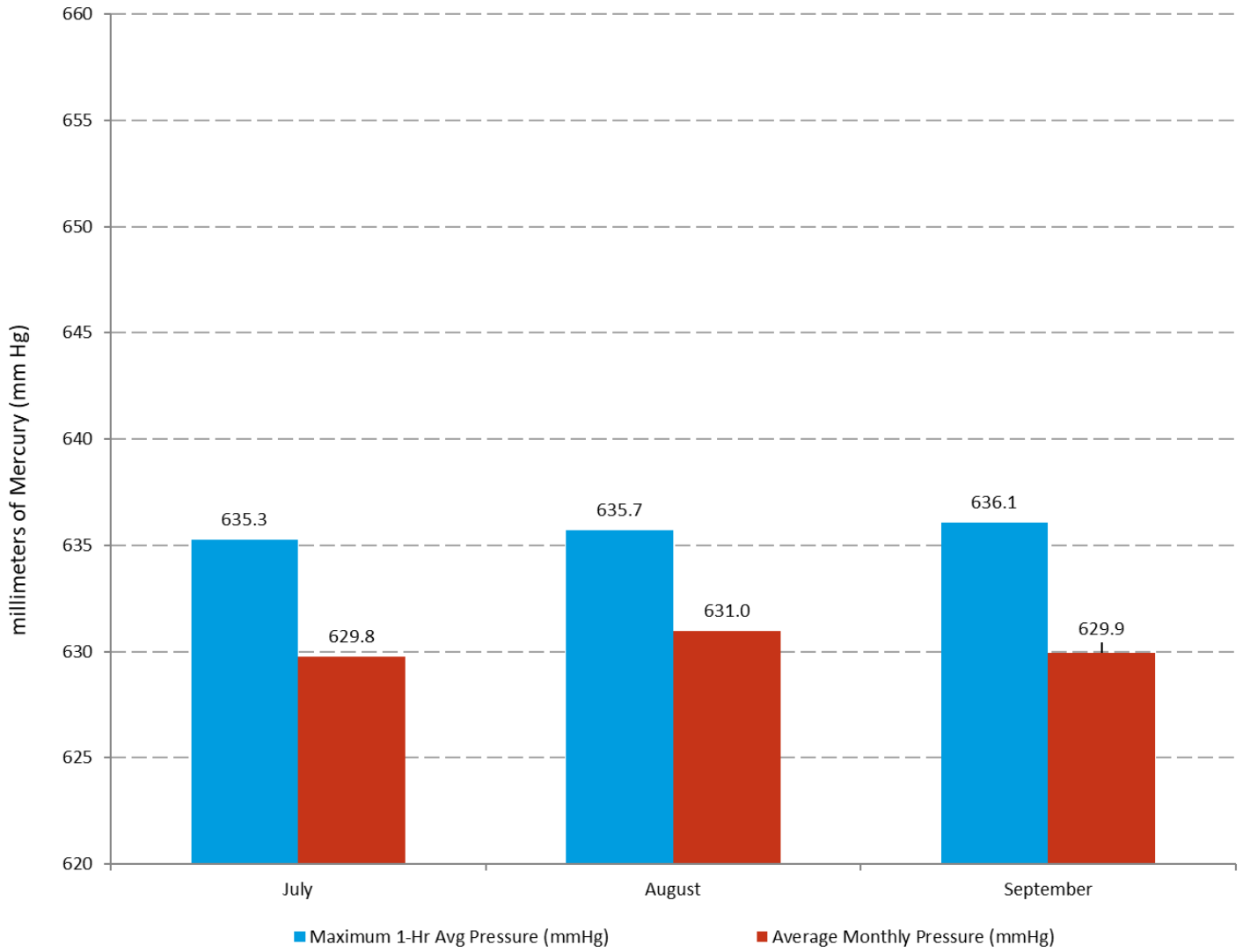


Figure 23. Hereford Q3 2025 Barometric Pressure Summary

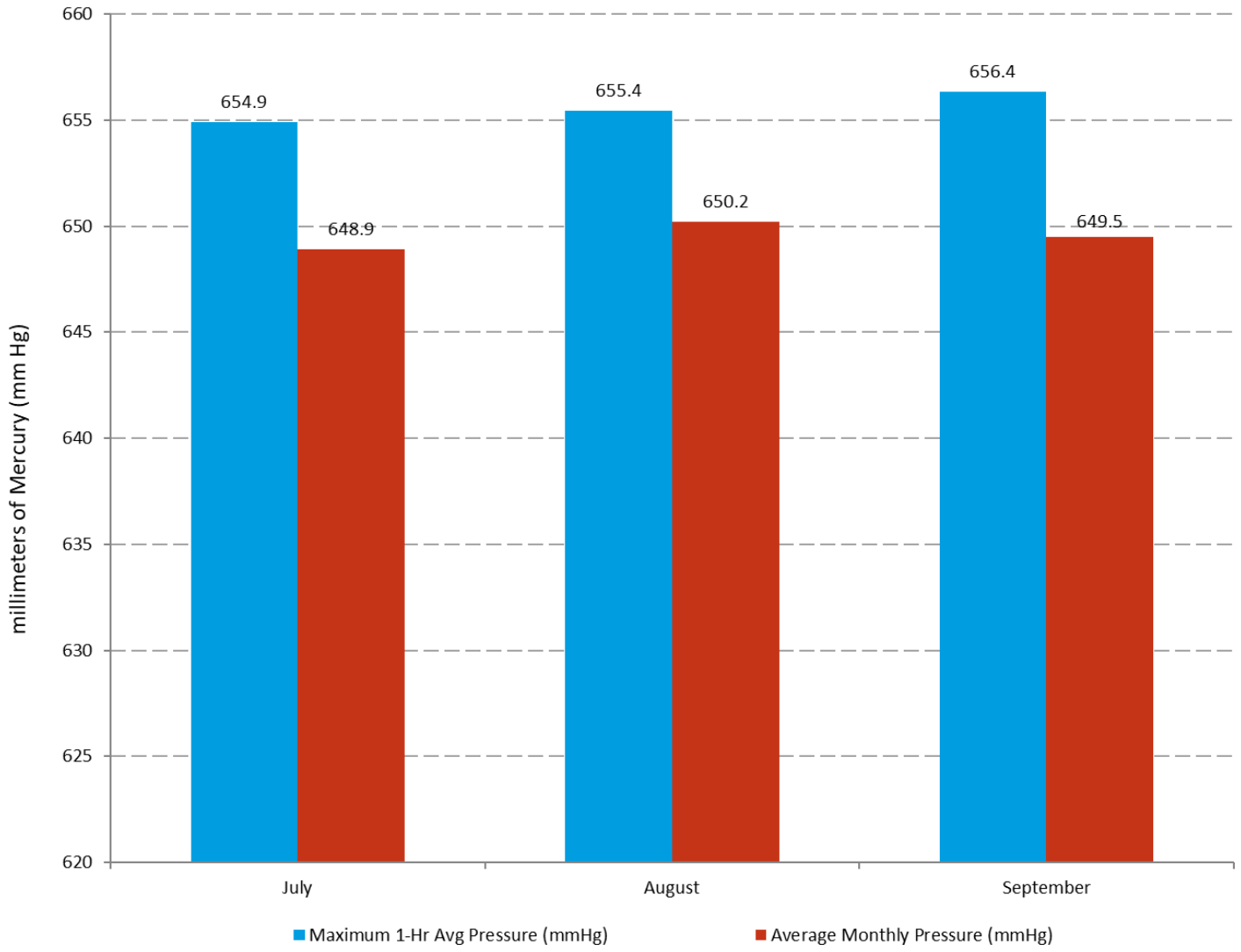


Figure 24. Orchard Q3 2025 Barometric Pressure Summary

6.6 Relative Humidity Data Summary

Relative humidity data was collected at all three stations at 2-m agl. The average monthly relative humidity at all three stations ranged between 53.0% and 66.4%. Maximum hourly average and monthly average relative humidity for Q3 2025 at all three stations is summarized in **Figure 25** through **Figure 27** and **Table 11**.

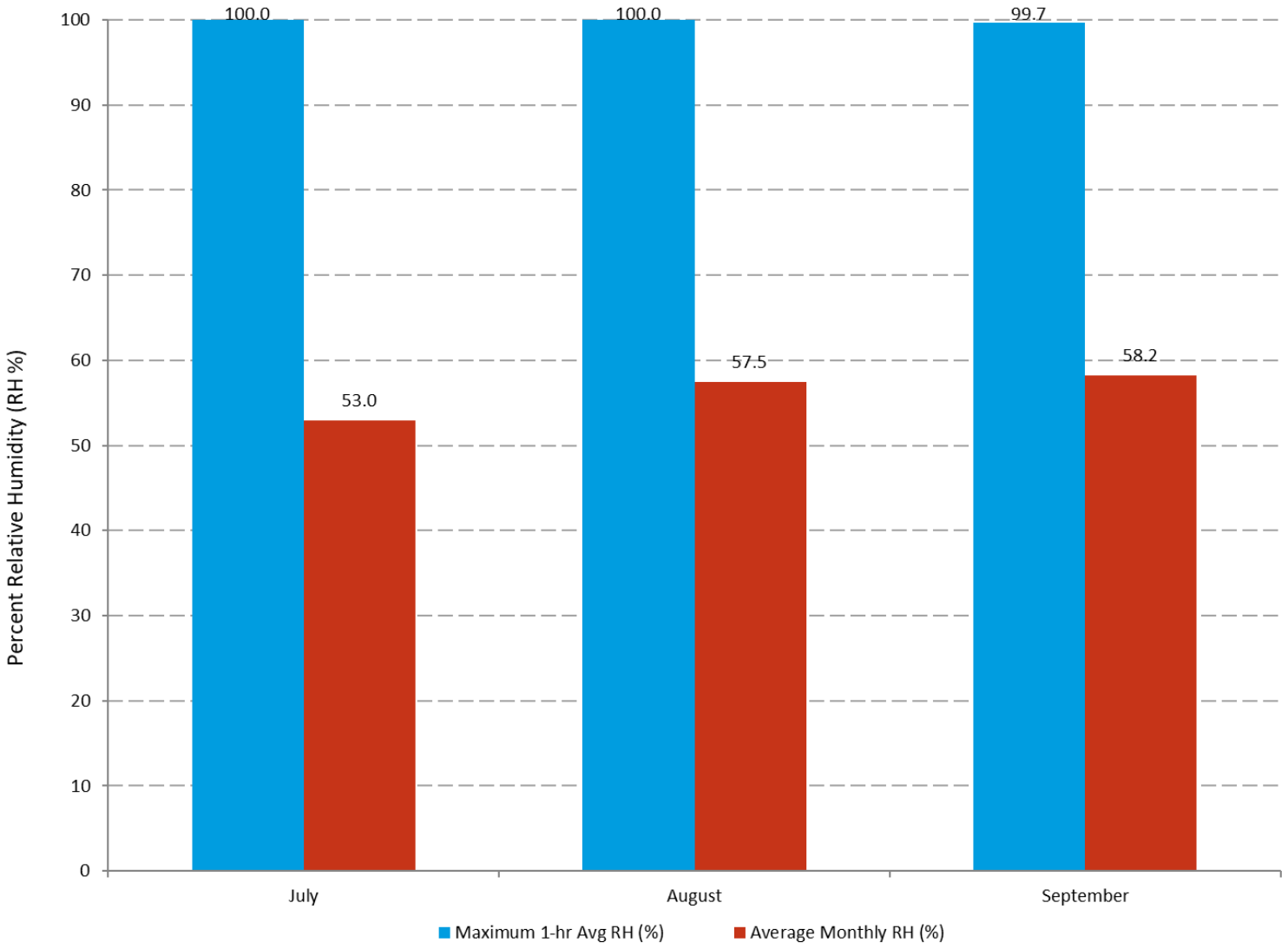


Figure 25. MSP Q3 2025 Relative Humidity Summary

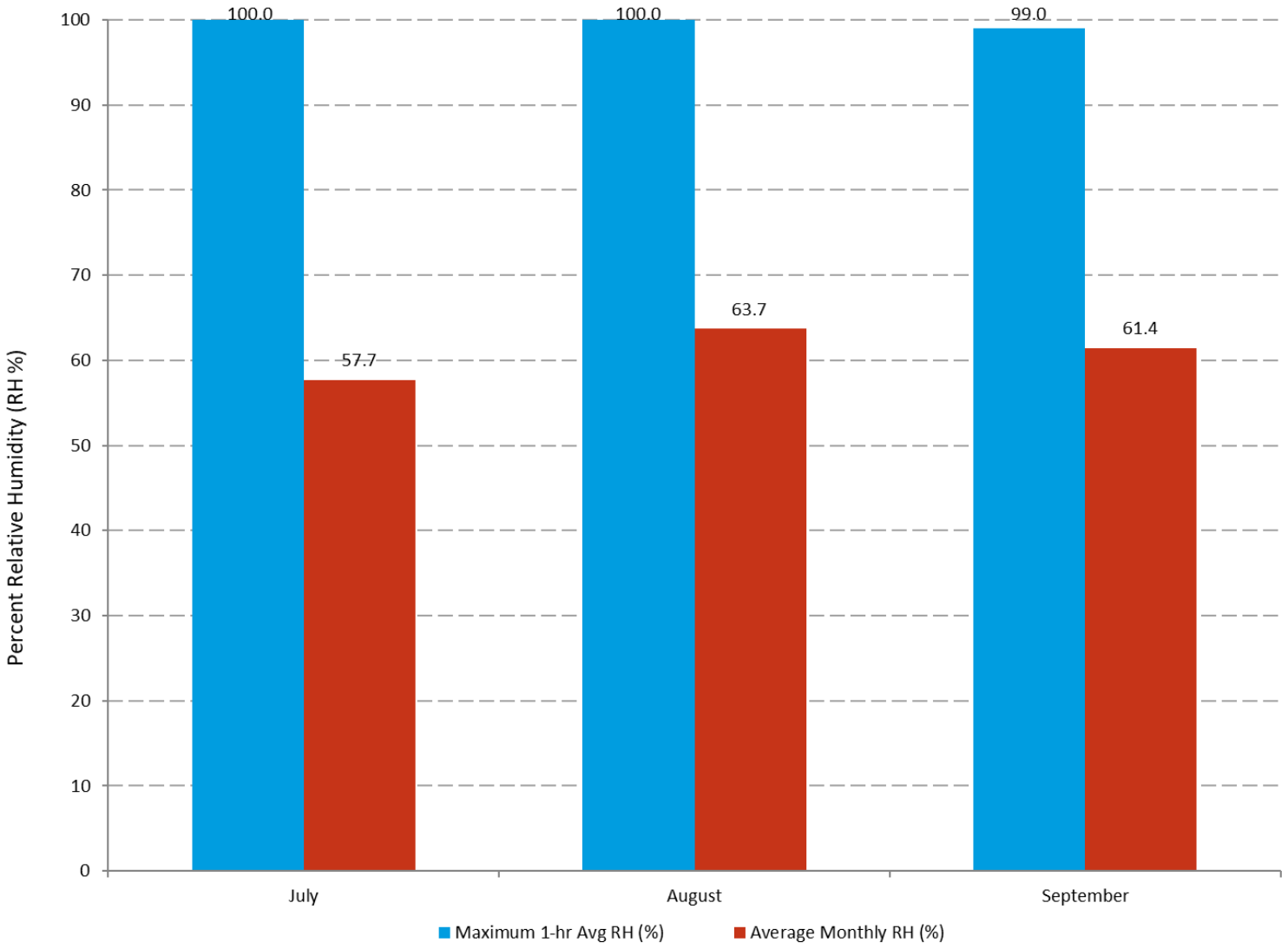


Figure 26. Hereford Q3 2025 Relative Humidity Summary

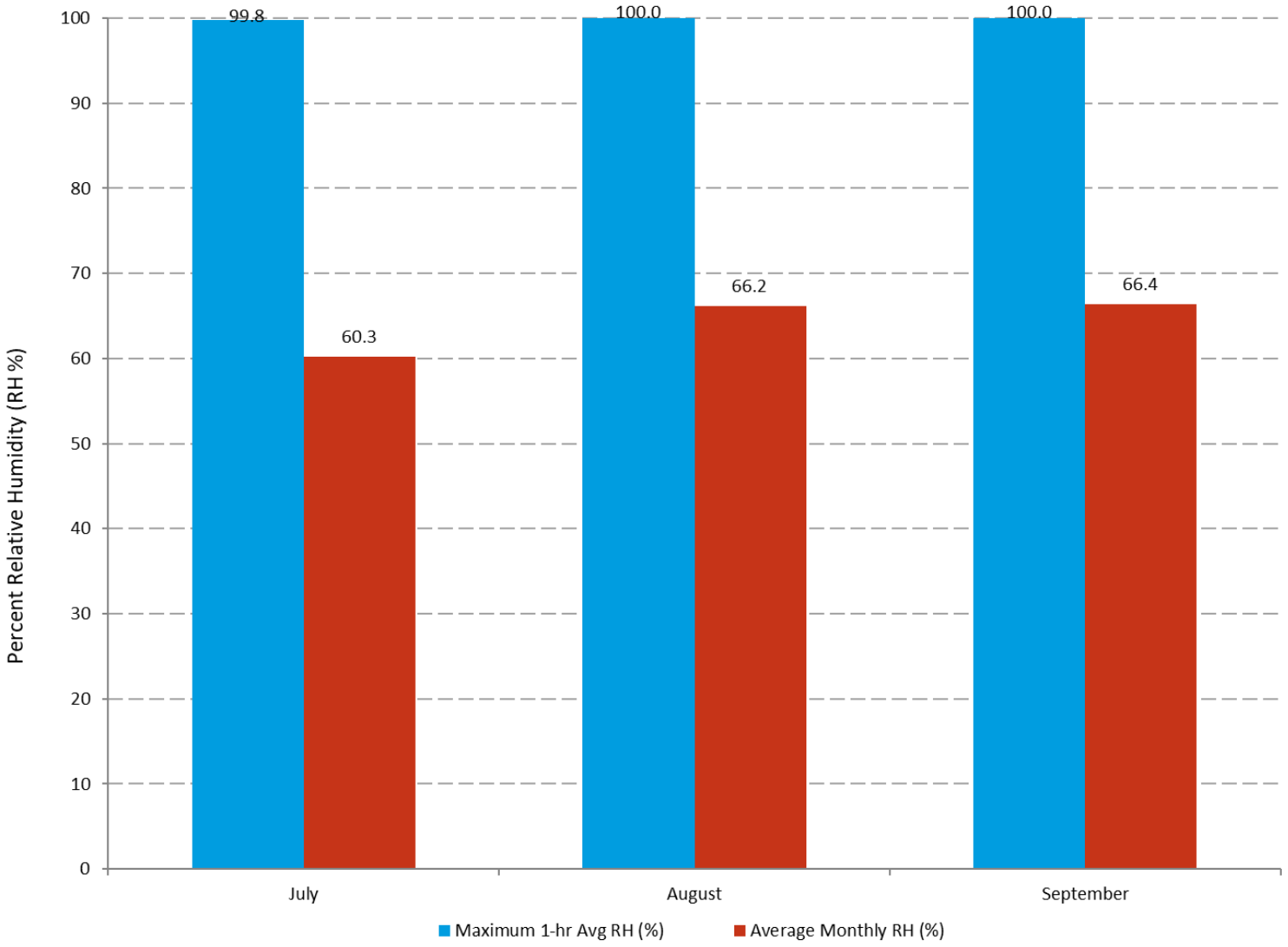


Figure 27. Orchard Q3 2025 Relative Humidity Summary

6.7 Solar Radiation Data Summary

Solar Radiation data was collected at 2-m agl at all three stations using a cross-arm mounted sensor on the meteorology tower. The average solar radiation decreased from July to September at all three stations, while 1-hour maximum solar radiation occurred in July at all three sites. Maximum hourly average and monthly average solar radiation for Q3 2025 at all three stations is summarized in **Figure 28** through **Figure 30** and **Table 11**.

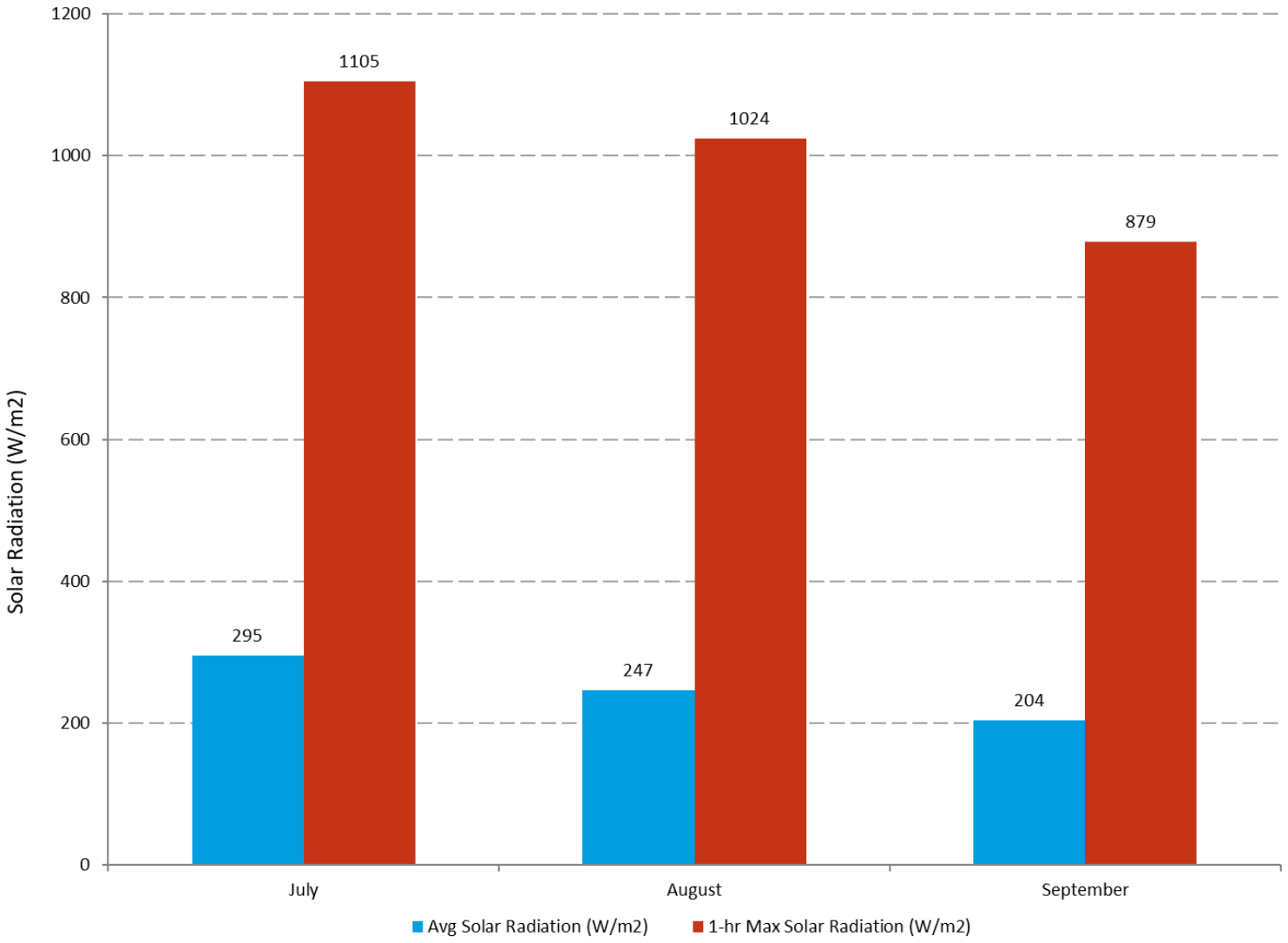


Figure 28. MSP Q3 2025 Solar Radiation Summary

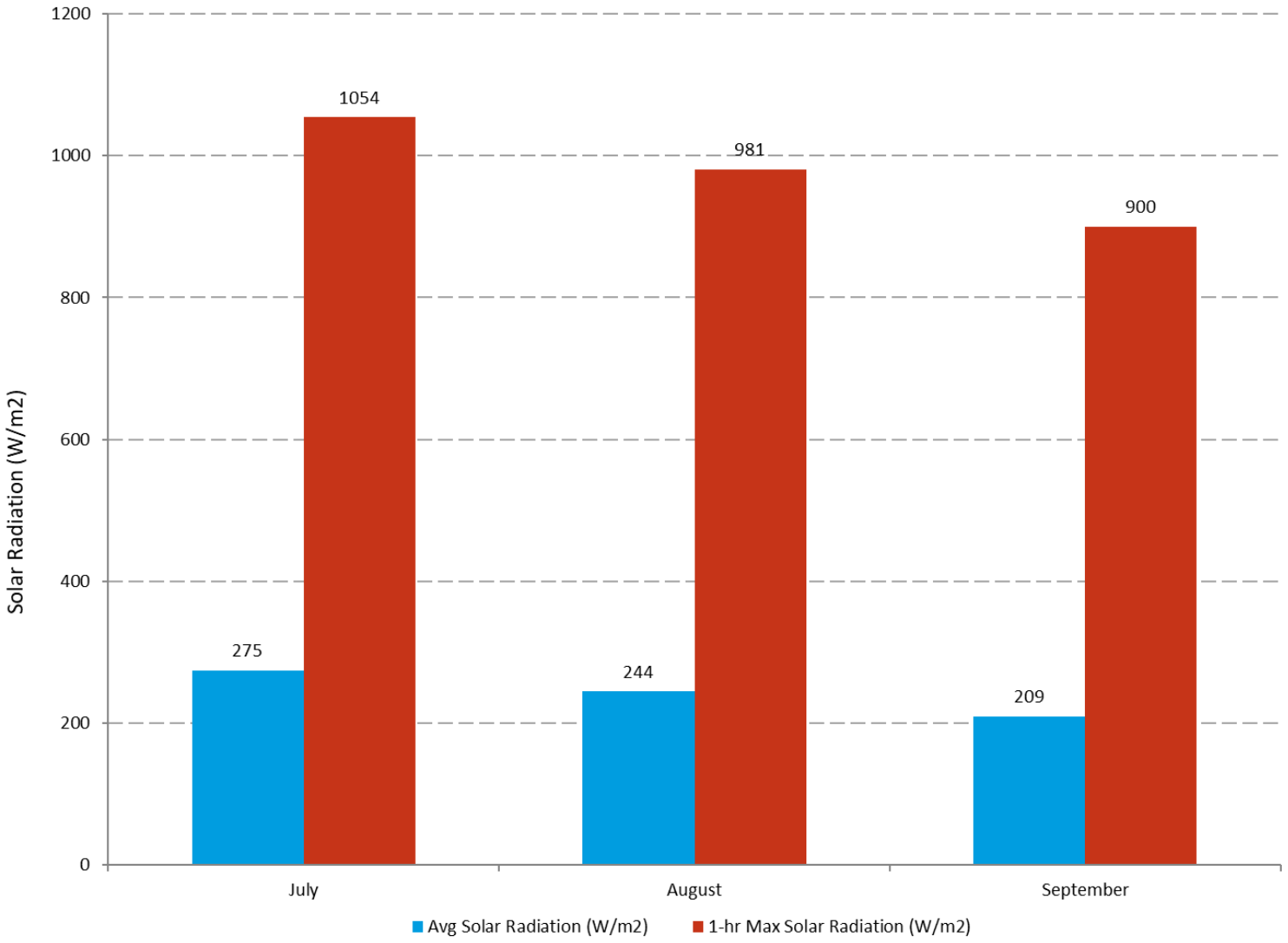


Figure 29. Hereford Q3 2025 Solar Radiation Summary

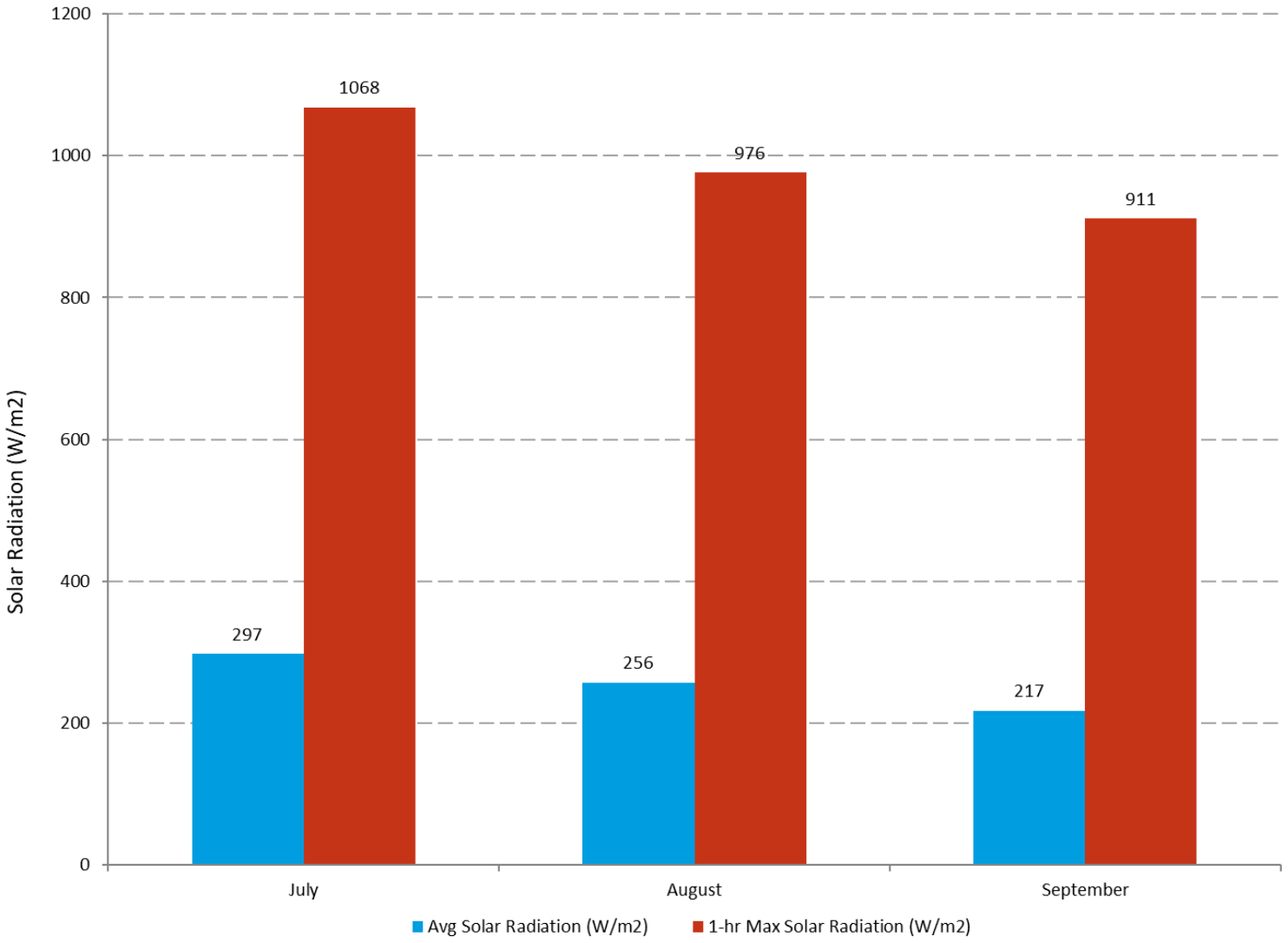


Figure 30. Orchard Q3 2025 Solar Radiation Summary

7. QUARTERLY REPORT DATA SUMMARY

Program activities conducted during Q3 2025 included data collection, equipment programming and calibrations, station inspections, routine maintenance, equipment troubleshooting and repair, routine data acquisition, data screening and validation, and report preparation. Data completeness goals were met for all parameters at all stations, except for solar radiation at MSP. Data completeness for O_3 will be evaluated once the O_3 season is complete in December 2025 in accordance with the data completeness targets.

Air quality data collected includes O_3 at all three stations and $NO/NO_2/NO_x$ at the MSP station. All daily maximum 8-hour average O_3 concentrations measured at MSP, Hereford and Orchard stations during Q3 2025 were below both the 2008 and the 2015 AAQS. Comparison to the 2008 and 2015 AAQS standards for 2025 will be made at the conclusion of the ozone season.

The maximum year-to-date 1-hour average concentration of NO_2 at MSP was 42.9 ppb, which is below the AAQS standard of 100 ppb. The 1-hour average NO_2 standard is based on the 98^{th} percentile of 1-hour daily maximum concentrations, averaged over 3-years. Comparison to the AAQS 1-hour (100 ppb) and annual (53 ppb) NO_2 standards for 2025 will be made at the conclusion of the calendar year, after a full year of data has been collected.

The meteorological data was all within normal ranges for the area and season. Temperatures were similar to Q3 2024, but warmer than Q3 2023.

APPENDIX A: Q3 2025 CONTINGENCY CALIBRATION RESULTS

APPENDIX A1: RAMBOLL CALIBRATION RESULTS

TABLE A1-1
GAS CALIBRATION AS LEFT REPORT

AUDIT DATE: 8/6/025
AUDITED BY: Jake Zaragoza, Ramboll
SITE: Missile Site Park

ANALYZER DEVICE: TELEDYNE API T400 O3 ANALYZER, RANGE 0 - 500 PPB O3
AUDIT DEVICE: TELEDYNE API T700 MULTI-GAS CALIBRATOR

Time Keeping	Ozone Audit						Diagnostics		
Calibrations Start Time	Audit Point	Uncorrected Audit Conc. (PPB)	Corrected Audit Conc. (PPB)	O_3 (PPB)	O_3 % diff.	Pass/Fail		T700	T400
9:04:00 AM	Zero	0.9	0.9	0.25	N/A	N/A	Serial Number	4969	5986
	1	50.1	50.1	50.11	0.0	PASS	O_3 Slope	0.9860	1.10
	2	99.5	99.5	99.82	0.3	PASS	O_3 Offset	0.1000	-2.90
	3	199.9	199.9	200.21	0.2	PASS	L3 O_3 Slope Correction Factor	1.0000	
Calibrations Stop Time	4	299.4	299.4	300.79	0.5	PASS	L3 O_3 Offset Correction Factor	0.0000	
11:11:00 AM	5	399.2	399.2	401.84	0.7	PASS	Box Temp (C)	29.2	25.5
							Sample Temp (C)	38.3	34.2
							Ph. Lamp Temp (C)	58.0	58.0
							Ozone Gen Lamp Temp (C)	48.0	
							Photo Flow (lpm)	0.726	
							Photo Press (in Hg)	24.8	
							Sample Flow (cc/min)		705.3
							Sample Press (in Hg)		22.8
							O3 Ref (mV)	4047.7	4305.4

Linear Regression	
	O3
Slope	1.007
Intercept	-0.608
Correlation	1.0000
Avg % diff.	0.32

Key:

NO_2	Nitrogen Dioxide	%	Percent
NO_x	Oxides of Nitrogen	TAPI	Teledyne Advanced Pollution Instrumentatio
N/A	Not Applicable	Avg	Average
orig.	Original	Conc.	Concentration
PPB	Parts Per Billion	diff.	Difference
slpm	Standard liters per minute	GPT	Gas Phase Titration
rem.	Remaining	NO	Nitrogen Oxide

NOTES: As found offset: -1.8 ppb, slope: 1.010. Multipoint performed after failed nightly checks.

TABLE A1-2
GAS CALIBRATION AS LEFT REPORT

AUDIT DATE: 8/13/2025
AUDITED BY: Jake Zaragoza, Ramboll
SITE: Missile Site Park

ANALYZER DEVICE: TELEDYNE API T400 O3 ANALYZER, RANGE 0 - 500 PPB O3
AUDIT DEVICE: TELEDYNE API T700 MULTI-GAS CALIBRATOR

Time Keeping	Ozone Audit						Diagnostics		
Calibrations Start Time	Audit Point	Uncorrected Audit Conc. (PPB)	Corrected Audit Conc. (PPB)	O_3 (PPB)	O_3 % diff.	Pass/Fail		T700	T400
12:36:00 PM	Zero	-1.2	-1.2	0.16	N/A	N/A	Serial Number	4969	5986
	1	49.7	49.7	51.50	3.6	PASS	O_3 Slope	0.9800	1.05
	2	100.0	100	101.66	1.7	PASS	O_3 Offset	-0.6000	-3.60
	3	200.5	200.5	201.44	0.5	PASS	L3 O_3 Slope Correction Factor	1.0000	
Calibrations Stop Time	4	300.5	300.5	300.77	0.1	PASS	L3 O_3 Offset Correction Factor	0.0000	
2:56:00 PM	5	399.8	399.8	401.63	0.5	PASS	Box Temp (C)	29.2	27.2
							Sample Temp (C)	39.5	35.9
							Ph. Lamp Temp (C)	58.0	58.0
							Ozone Gen Lamp Temp (C)	48.0	
							Photo Flow (lpm)	0.692	
							Photo Press (in Hg)	24.6	
							Sample Flow (cc/min)		703
							Sample Press (in Hg)		22.9
							O3 Ref (mV)	4025.6	4254.6

Key:			
NO_2	Nitrogen Dioxide	%	Percent
NO_x	Oxides of Nitrogen	TAPI	Teledyne Advanced Pollution Instrumentatio
N/A	Not Applicable	Avg	Average
orig.	Original	Conc.	Concentration
PPB	Parts Per Billion	diff.	Difference
slpm	Standard liters per minute	GPT	Gas Phase Titration
rem.	Remaining	NO	Nitrogen Oxide

Linear Regression	O3
Slope	0.999
Intercept	1.485
Correlation	1.0000
Avg % diff.	1.26

NOTES: As found offset: -2.9 ppb, slope: 1.095. Nafion found to cause ozone losses, it was removed and this was the post check.

TABLE A1-3
GAS CALIBRATION AS LEFT REPORT

AUDIT DATE: 9/30/2025
AUDITED BY: Bode Hoover, Ramboll
SITE: Missile Site Park

ANALYZER DEVICE: TELEDYNE API T400 O3 ANALYZER, RANGE 0 - 500 PPB O3
AUDIT DEVICE: TELEDYNE API T700 MULTI-GAS CALIBRATOR

Time Keeping	Ozone Audit						Diagnostics		
Calibrations Start Time	Audit Point	Uncorrected Audit Conc. (PPB)	Corrected Audit Conc. (PPB)	O_3 (PPB)	O_3 % diff.	Pass/Fail		T700	T400
10:35:00 AM	Zero	-1.5	-1.5	1.20	N/A	N/A	Serial Number	4969	5986
	1	400.2	400.2	404.99	1.2	PASS	O_3 Slope	0.9800	1.05
	2	49.8	49.8	52.98	6.4	PASS	O_3 Offset	-0.6000	-3.60
	3	99.5	99.5	103.44	4.0	PASS	L3 O_3 Slope Correction Factor	1.0000	
Calibrations Stop Time	4	200.1	200.1	204.55	2.2	PASS	L3 O_3 Offset Correction Factor	0.0000	
11:56:00 AM	5	299.6	299.6	305.53	2.0	PASS	Box Temp (C)	30.9	28.9
							Sample Temp (C)	41.1	35.8
							Ph. Lamp Temp (C)	58.0	58.0
							Ozone Gen Lamp Temp (C)	48.0	
							Photo Flow (lpm)	0.000	
							Photo Press (in Hg)	25.0	
							Sample Flow (cc/min)		695.5
							Sample Press (in Hg)		22.7
							O3 Ref (mV)	3957.5	3992.9

Key:

NO_2	Nitrogen Dioxide	%	Percent
NO_x	Oxides of Nitrogen	TAPI	Teledyne Advanced Pollution Instrumentatio
N/A	Not Applicable	Avg	Average
orig.	Original	Conc.	Concentration
PPB	Parts Per Billion	diff.	Difference
slpm	Standard liters per minute	GPT	Gas Phase Titration
rem.	Remaining	NO	Nitrogen Oxide

Linear Regression	O3
Slope	1.006
Intercept	3.044
Correlation	1.0000
Avg % diff.	3.15

NOTES: Diagnostics taken after calibration. New Nafion installed.

APPENDIX A2: INDEPENDENT CALIBRATION RESULTS

TROUBLESHOOTING REPORT

Prepared by Air Resource Specialists, Inc.

Client:	Ramboll	**Field Personnel:**	Jon Wenrick
Site:	Missile Park	**Service Date(s):**	8/13/2025
Site Operator:	Jake Zargoza	**Subject:**	T400 Audit/Troubleshooting

All site visit and calibration forms are attached, detailing the test results. This report is not complete without the inclusion of the calibration form worksheets.

SUMMARY OF FINDINGS

GASEOUS POLLUTANT ANALYZERS

Ozone Analyzer (Teledyne-API T400):

Back of analyzer (BOA) audit configuration was used for initial delivery of 401.8 ppb O3, which resulted in T400 response of 421.6 ppb. After 30 minutes of conditioning with high concentration ozone, I delivered level 3-5 audit concentrations in descending order. The site analyzer responded within audit criteria. Response ranged from 2.8%-4.7% high. To troubleshoot, we first used the site's calibration line to deliver ozone concentrations from the audit T700U. During this test, I sent a concentration of 399.5 ppb and the site analyzer response was 391.9 ppb. Next, we bypassed the Nafion dryer and continued delivering ozone through the calibration line. In this configuration, the T400 response was 412.6 ppb when 400.1 ppb was being delivered. Next, we used the site's T700 to deliver ozone directly to the T400. In this configuration, the T400 response was 412.5 ppb on a delivered concentration of 399.8 ppb. After completing this test, the site's reference photometer slope/offset were found to be incorrect based on the most recent reverification. Those factors were modified to the correct calibration factors. Two final tests were run in a BOA configuration. We first delivered 399.6 ppb from the site's T700 which yielded a response of 415.7 ppb on the T400. The ARS audit T700U was then connected to the T400 in the same BOA configuration, delivering a concentration of 399.5 ppb, which yielded a response of 417.7 ppb on the T400.

ADDITIONAL COMMENTS

The site T400 analyzer was found to be in good working order. The low ozone response observed when delivering ozone through the inlet can largely be attributed to the Nafion dryer assembly.

Air Resource SPECIALISTS

OZONE ANALYZER AUDIT

ABBR.	N/A				
CLIENT	Ramboll	FIELD SPECIALIST	Jon Wenrick	DATE	8/13/2025
SITE NAME	Missile Park Monitoring Site				

AUDIT STANDARD		AMBIENT ANALYZER	
Manufacturer	Teledyne-API	Manufacturer / Model	Teledyne-API T400
Model	T700U	Serial Number	5986
Serial Number	129	Slope	1.095
Slope	0.978	Offset	-2.9
Offset	-1.1	Photo Ref (mV)	4097.5
Photo Ref (mV)	4260.1		
		Sample Flow (lpm)	0.710
Sample Flow (lpm)	0.8953		
		Sample Pressure (inHg)	23.0
Sample Pressure (inHg)	24	Box Temp (°C)	27.9
Box Temp (°C)	30.5	Photo Lamp (°C)	58
Photo Lamp (°C)	58	Ozone Gen Lamp (°C)	
Ozone Gen Lamp (°C)	48	Sample Temp (°C)	35.5
Sample Temp (°C)	35.4		
		Full Scale (ppb)	500

	SLOPE	INT
Audit Standard Correction Factors	1.0000	0.0000

AUDIT CRITERIA (<=)		
Percent Difference of each audit level (%)	15%	PASS
OR Absolute Difference at Level 1&2 (ppb)	1.5	PASS

		O3 LAMP	AUDIT STANDARD		AMBIENT ANALYZER					
Conc. Range (ppb)	TARGET	% or mV	Display	Corrected	DAS	Diff	%Diff	%LIN	P/F	LEVEL
0	0		0.3	0.3	-0.9	-1.2	N/A	0.0%	N/A	LEVEL
70-89	75		80.4	80.4	84.2	3.8	4.7%	0.0%	PASS	5
40-69	55		59.8	59.8	62.0	2.2	3.7%	0.0%	PASS	4
20-39	30		35.5	35.5	36.5	1.0	2.8%	0.0%	PASS	3
6-19	15									

AMBIENT ANALYZER	
Slope	1.061
Y-Intercept	-1.23
Correlation	1.0000

NOTES:

SITE INFORMATION

ABBR.	N/A				
CLIENT	Ramboll	FIELD SPECIALIST	Jon Wenrick	DATE	8/13/2025
SITE NAME	Missile Park Monitoring Site				

		Deg	Min	Sec		Decimal
LATITUDE	North	40	25	44.2	--CALCULATE->	40.4289
LONGITUDE	West	104	51	41.3		104.8615

NOTES:	

Air Resource SPECIALISTS

CALIBRATION AND VERIFICATION STANDARDS

ABBR.	N/A				
CLIENT	Ramboll	FIELD SPECIALIST	Jon Wenrick	DATE	8/13/2025
SITE NAME	Missile Park Monitoring Site				

	MANUFACTURER	MODEL	SERIAL #	Calibration Expiration Date
Ozone Transfer Standard	Teledyne-API	T700U	129	12/31/2025
Gas Dilution Transfer Standard				
MFC High Flow Reference				
MFC Low Flow Reference				
Temperature Reference				
AT/RH Sensor Reference				
Barometric Pressure Reference				
Wind Speed Reference (high rpm)				
Wind Speed Reference (low rpm)				
Wind Speed Torque Gauge				
Wind Direction Alignment Reference				
Wind Direction Linearity Reference				
Wind Direction Torque Gauge				
Solar Radiation Reference #1				
Solar Radiation Reference #2				
UV Radiation Reference				
Multiplier		W/m2 / mV		
Precipitation Reference				
Volume		mL		

PM Flow Standard #1				
PM Flow Standard #2				
PM Flow Standard #3				
PM Flow Standard #4				

PM Temperature Standard #1				
PM Temperature Standard #2				
PM Temperature Standard #3				
PM Temperature Standard #4				

PM Barometric Pressure Standard #1				
PM Barometric Pressure Standard #2				
PM Barometric Pressure Standard #3				
PM Barometric Pressure Standard #4				

TEOM MTV Standard				

HiVol Direct Flow Reference				
Orifice				
ΔP orifice manometer				

Air Resource SPECIALISTS

LEVEL 3 FIELD OZONE TRANSFER STANDARD REVERIFICATION (page 1 of 1)

Institute Conducting Verification:	Air Resource Specialist, Inc.
Operator:	Brian Orth
Date:	7/2/2025

NOTES

Transfer Standard of Higher Authority

Transfer Standard Role:	LEVEL 2 BENCH
Make:	Thermo
Model:	49IPS
Serial Number:	721223194
Verification Date:	12/20/2024

Calibration Factors

Span Setting:	1.01
Zero Setting:	0.1

PASS	
Instrument Internal Calibration Factors	
SLOPE	0.978
INT	-1.1

Candidate Transfer Standard Information

Candidate Transfer Standard Role:	LEVEL 3 FIELD
Make:	Teledyne-API
Model:	T700U
Serial Number:	129
Preventive Maintenance Date:	7/1/2025
Acceptance Testing Date:	7/2/2025

Reverification Due
12/31/2025
Recommended By
10/1/2025

Calibration Factors

Span Setting:	0.978
Zero Setting:	-1.1

Regression Values	
SLOPE	0.996
INT	-0.065

CYCLE 1			
Date	7/2/2025		Reverification
Regression Slope	0.999	PASS	PASS
Regression Intercept	0.186	PASS	PASS

POINT	Higher Level	Candidate	Difference	% Difference	Pass/Fail
0	-0.2	0.1	0.3	N/A	PASS
1	469.3	469.2	-0.1	0.0%	PASS
2	370.1	370.2	0.1	0.0%	PASS
3	270.0	270.0	0.0	0.0%	PASS
4	170.1	170.0	-0.1	-0.1%	PASS
5	69.6	69.9	0.3	0.4%	PASS
6	34.6	34.7	0.1	0.3%	PASS
7	15.5	15.8	0.3	1.9%	PASS
8					
9					
10					
0	-0.2	-0.2	0.0	N/A	PASS

APPENDIX B: Q3 2025 INVALIDATION PERIODS AND CORRECTIVE ACTION REPORTS

APPENDIX B1: INVALIDATION PERIODS

APPENDIX B1: PERIODS OF INVALID DATA AND QUALIFIER CODES

Data is presented by Month, Parameter, Qualifier Code, Date and Time, and Description

Qualifier Codes			
Code	**Description**	**Code**	**Description**
2	Operational Deviation: -Calibrator slope & offset incorrect -The standard deviation of shelter temperature was above 2.1°C for the previous 24 hours	AV	Power Failure
AC	Construction / Repairs in Area	AW	Wildlife Damage
AE	Shelter Temperature Outside of Limits	BA	Maintenance / Routine Repairs
AM	Miscellaneous Void	BC	Multi-point Calibration
AN	Machine Malfunction	BD	Auto Calibration
AS	Poor Quality Assurance Results	V	Value Validated
AT	Calibration		

Periods of Invalidation				
Month	**Parameter**	**Code**	**Date and Time**	**Description**
MISSILE SITE PARK				
July	2 m, 10 m, & Delta Temperature	AN	07/09/2025 21:00	WS below 3 m/s and no power to aspirators
	Precipitation	AT	07/29/2025 14:00	Calibration testing
	Ozone/NO/NO2/NOx	2	07/01/2025 00:00-07/31/2025 23:00	**Ozone ONLY**: Calibrator slope & offset incorrect
		BD	07/01/2025 02:00	Overnight calibration
		BD	07/02/2025 02:00	Overnight calibration
		BD	07/03/2025 01:00-02:00	Overnight calibration
		BD	07/04/2025 02:00	Overnight calibration
		BD	07/05/2025 02:00	Overnight calibration
		BD	07/06/2025 01:00-02:00	Overnight calibration
		BD	07/07/2025 02:00	Overnight calibration
		BD	07/08/2025 02:00	Overnight calibration
		BD	07/09/2025 02:00	Overnight calibration
		V	07/09/2025 11:00-12:00	Value validated. Partial hours due to calibration testing.
		BA	07/09/2025 14:00-16:00	Inlet maintenance/testing
		V	07/09/2025 17:00	Value validated. Partial hour due to inlet maintenance/testing.
		AV	07/09/2025 20:00-23:00	Power outage

Periods of Invalidation				
Month	**Parameter**	**Code**	**Date and Time**	**Description**
		AV	07/10/2025 00:00	**NO/NO2/NOx ONLY:** Analyzer not settled after power outage.
		BD	07/10/2025 01:00-02:00	Overnight calibration
		BD	07/11/2025 02:00	Overnight calibration
		BD	07/12/2025 02:00	Overnight calibration
		BD	07/13/2025 01:00-02:00	Overnight calibration
		BD	07/14/2025 02:00	Overnight calibration
		BD	07/15/2025 02:00	Overnight calibration
		BD	07/16/2025 02:00	Overnight calibration
		BD	07/17/2025 01:00-02:00	Overnight calibration
		BD	07/18/2025 02:00	Overnight calibration
		BD	07/19/2025 02:00	Overnight calibration
		BD	07/20/2025 01:00-02:00	Overnight calibration
		BD	07/21/2025 02:00	Overnight calibration
		BD	07/22/2025 02:00	Overnight calibration
		BD	07/23/2025 02:00	Overnight calibration
		BD	07/24/2025 01:00-02:00	Overnight calibration
		BD	07/25/2025 02:00	Overnight calibration
		BD	07/26/2025 02:00	Overnight calibration
		BD	07/27/2025 01:00-02:00	Overnight calibration
		BD	07/28/2025 02:00	Overnight calibration
		BD	07/29/2025 02:00	Overnight calibration
		AM	07/29/2025 14:00	Filter change
		V	07/29/2025 15:00	Value validated. Partial hour due to filter change.
		BD	07/30/2025 02:00	Overnight calibration
		BD	07/31/2025 01:00-02:00	Overnight calibration
August	Solar Radiation	AW	08/31/2025 01:00-09/01/2025 00:00	Sensor covered in bird excrement
	Ozone/NO/NO2/NOx	2	08/01/2025 01:00-08/13/2025 12:00	**Ozone ONLY**: Calibrator slope & offset incorrect
		BD	08/01/2025 02:00	Overnight calibration
		AS	08/01/2025 03:00-08/06/2025 09:00	**Ozone ONLY:** Poor QA Results
		BD	08/02/2025 02:00	Overnight calibration
		BD	08/03/2025 01:00-02:00	Overnight calibration

Periods of Invalidation				
Month	**Parameter**	**Code**	**Date and Time**	**Description**
		BD	08/04/2025 02:00	Overnight calibration
		BD	08/05/2025 02:00	Overnight calibration
		BD	08/06/2025 02:00	Overnight calibration
		BC	08/06/2025 10:00-11:00	Multi-point calibration
		V	08/06/2025 12:00	Value validated. Partial hour due to multi-point calibration.
		BD	08/07/2025 01:00-02:00	Overnight calibration
		BD	08/08/2025 02:00	Overnight calibration
		BD	08/09/2025 02:00	Overnight calibration
		BD	08/10/2025 01:00-02:00	Overnight calibration
		BD	08/11/2025 02:00	Overnight calibration
		BD	08/12/2025 02:00	Overnight calibration
		BD	08/13/2025 02:00	Overnight calibration
		AS	08/13/2025 03:00-08:00	**Ozone ONLY:** Quality assurance not verified prior to inlet maintenance
		V	08/13/2025 08:00	**NO/NO2/NOx ONLY:** Value validated. Partial hour due to inlet maintenance and testing.
		BA	08/13/2025 09:00-12:00	Inlet maintenance and testing
		BC	08/13/2025 13:00-15:00	Multi-point calibration following maintenance.
		BD	08/14/2025 01:00-02:00	Overnight calibration
		BD	08/15/2025 02:00	Overnight calibration
		BD	08/16/2025 02:00	Overnight calibration
		BD	08/17/2025 01:00-02:00	Overnight calibration
		BD	08/18/2025 02:00	Overnight calibration
		BD	08/19/2025 02:00	Overnight calibration
		BD	08/20/2025 02:00	Overnight calibration
		BD	08/21/2025 01:00-02:00	Overnight calibration
		BD	08/22/2025 02:00	Overnight calibration
		BD	08/23/2025 02:00	Overnight calibration
		BD	08/24/2025 01:00-02:00	Overnight calibration
		BD	08/25/2025 02:00	Overnight calibration
		BD	08/26/2025 02:00	Overnight calibration
		V	08/26/2025 13:00	Value validated. Partial hour due to filter change.

Periods of Invalidation				
Month	**Parameter**	**Code**	**Date and Time**	**Description**
		AM	08/26/2025 14:00	Filter change
		BD	08/27/2025 02:00	Overnight calibration
		BD	08/28/2025 01:00-02:00	Overnight calibration
		BD	08/29/2025 02:00	Overnight calibration
		BD	08/30/2025 02:00	Overnight calibration
		BD	08/31/2025 01:00-02:00	Overnight calibration
September	Solar Radiation	AW	09/01/2025 01:00-09/09/2025 14:00	Sensor covered in bird excrement
	Ozone/NO/NO2/NOx	BD	09/01/2025 02:00	Overnight calibration
		BD	09/02/2025 02:00	Overnight calibration
		BD	09/03/2025 02:00	Overnight calibration
		BD	09/04/2025 01:00-02:00	Overnight calibration
		BD	09/05/2025 02:00	Overnight calibration
		BD	09/06/2025 02:00	Overnight calibration
		BD	09/07/2025 01:00-02:00	Overnight calibration
		BD	09/08/2025 02:00	Overnight calibration
		BD	09/09/2025 02:00	Overnight calibration
		BD	09/10/2025 02:00	Overnight calibration
		V	09/10/2025 09:00	Value validated. Partial hour due to manual calibration.
		AT	09/10/2025 10:00	Manual calibration
		BD	09/11/2025 01:00-02:00	Overnight calibration
		BD	09/12/2025 02:00	Overnight calibration
		BD	09/13/2025 02:00	Overnight calibration
		BD	09/14/2025 01:00	Overnight calibration
		V	09/15/2025 02:00	Value validated. Partial hour due to incomplete calibration.
		V	09/15/2025 10:00	Value validated. Partial hour due to manual calibration attempt.
		BD	09/16/2025 02:00	Overnight calibration
		V	09/17/2025 02:00	Value validated. Partial hour due to incomplete calibration.
		V	09/18/2025 01:00	Value validated. Partial hour due to incomplete calibration.
		V	09/19/2025 02:00	Value validated. Partial hour due to incomplete calibration.
		V	09/25/2025 13:00	Value validated. Partial hour due to calibration testing.

Periods of Invalidation				
Month	**Parameter**	**Code**	**Date and Time**	**Description**
		AT	09/25/2025 14:00	Manual calibration
		BD	09/26/2025 02:00	Overnight calibration
		BD	09/27/2025 02:00	Overnight calibration
		BD	09/28/2025 01:00-02:00	Overnight calibration
		BD	09/29/2025 02:00	Overnight calibration
		BD	09/30/2025 02:00	Overnight calibration
		AT	09/30/2025 08:00	Manual calibration
		AS	09/30/2025 09:00	**Ozone ONLY**: Quality assurance not verified prior to Ozone Nafion addition.
		BA	09/30/2025 10:00	Inlet maintenance
		BC	09/30/2025 11:00-12:00	Multi-point calibration
		V	09/30/2025 13:00	Value validated: Partial hour due to filter change.
		AM	09/30/2025 14:00	Filter change
HEREFORD				
July	Panel Temperature	AV	07/14/2025 20:00	Power failure
	Wind Speed & Direction	AV	07/14/2025 20:00-21:00	Power failure
	2 m, 10 m, & Delta Temperature	AV	07/14/2025 20:00-21:00	Power failure
	Relative Humidity & Air Temperature (not regulatory)	AV	07/14/2025 20:00-21:00	Power failure
	Solar Radiation	AV	07/14/2025 20:00-21:00	Power failure
	Barometric Pressure	AV	07/14/2025 20:00-21:00	Power failure
	Precipitation	AV	07/14/2025 20:00	Power failure
	Ozone	BD	07/02/2025 02:00	Overnight calibration
		BD	07/04/2025 02:00	Overnight calibration
		BD	07/07/2025 02:00	Overnight calibration
		BD	07/09/2025 02:00	Overnight calibration
		BD	07/11/2025 02:00	Overnight calibration
		BD	07/14/2025 02:00	Overnight calibration
		AV	07/14/2025 19:00-21:00	Power failure
		BD	07/16/2025 02:00	Overnight calibration
		V	07/16/2025 15:00	Value validated. Partial hour due to power failure.
		BD	07/18/2025 02:00	Overnight calibration
		BD	07/21/2025 02:00	Overnight calibration

Periods of Invalidation				
Month	**Parameter**	**Code**	**Date and Time**	**Description**
		BD	07/23/2025 02:00	Overnight calibration
		BD	07/25/2025 02:00	Overnight calibration
		BD	07/28/2025 02:00	Overnight calibration
		BD	07/30/2025 02:00	Overnight calibration
		V	07/31/2025 13:00	Value validated. Partial hour due to filter change.
		AM	07/31/2025 14:00	Filter change
		V	07/31/2025 18:00	Value validated. Partial hour due to power failure.
August	Ozone	BD	08/01/2025 02:00	Overnight calibration
		BD	08/04/2025 02:00	Overnight calibration
		BD	08/06/2025 02:00	Overnight calibration
		BD	08/08/2025 02:00	Overnight calibration
		V	08/10/2025 17:00	Value validated. Partial hour due to power failure.
		BD	08/11/2025 02:00	Overnight calibration
		BD	08/13/2025 02:00	Overnight calibration
		BD	08/15/2025 02:00	Overnight calibration
		AT	08/15/2025 12:00	Manual calibration
		BD	08/18/2025 02:00	Overnight calibration
		BD	08/20/2025 02:00	Overnight calibration
		BD	08/22/2025 02:00	Overnight calibration
		BD	08/25/2025 02:00	Overnight calibration
		BD	08/27/2025 02:00	Overnight calibration
		V	08/28/2025 11:00	Value validated. Partial hour due to filter change.
		AM	08/28/2025 12:00	Filter change
		BD	08/29/2025 02:00	Overnight calibration
September	Ozone	BD	09/01/2025 02:00	Overnight calibration
		BD	09/03/2025 02:00	Overnight calibration
		BD	09/05/2025 02:00	Overnight calibration
		BD	09/08/2025 02:00	Overnight calibration
		BD	09/10/2025 02:00	Overnight calibration
		BD	09/12/2025 02:00	Overnight calibration
		BD	09/15/2025 02:00	Overnight calibration
		V	09/16/2025 07:00	Value validated. Partial hour due to power outage.
		BD	09/17/2025 02:00	Overnight calibration
		BD	09/19/2025 02:00	Overnight calibration
		BD	09/22/2025 02:00	Overnight calibration
		BD	09/24/2025 02:00	Overnight calibration
		BD	09/26/2025 02:00	Overnight calibration
		BD	09/29/2025 02:00	Overnight calibration

Periods of Invalidation				
Month	**Parameter**	**Code**	**Date and Time**	**Description**
		V	09/30/2025 07:00-08:00	Value validated. Partial hour due to calibration testing.
		AM	09/30/2025 10:00-11:00	Filter change
ORCHARD				
July	Ozone	BD	07/02/2025 02:00	Overnight calibration
		BD	07/04/2025 02:00	Overnight calibration
		BD	07/07/2025 02:00	Overnight calibration
		BD	07/09/2025 02:00	Overnight calibration
		2	07/09/2025 17:00-07/10/2025 18:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	07/11/2025 02:00	Overnight calibration
		BD	07/14/2025 02:00	Overnight calibration
		2	07/15/2025 17:00-07/16/2025 18:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	07/16/2025 02:00	Overnight calibration
		BD	07/18/2025 02:00	Overnight calibration
		2	07/18/2025 14:00-07/21/2025 01:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	07/21/2025 02:00	Overnight calibration
		AS	07/21/2025 03:00-07/24/2025 11:00	Poor quality assurance results
		AE	07/22/2025 15:00-20:00	Shelter temperature greater than 40°C
		AC	07/24/2025 12:00-07/31/2025 13:00	Analyzer off because of failed air conditioner
		AT	07/31/2025 14:00	Calibration testing
		V	07/31/2025 15:00	Value validated. Partial hour due to calibration testing.
		2	07/31/2025 16:00-22:00	Standard deviation of shelter temperature greater than 2.1°C
August	Ozone	BD	08/01/2025 02:00	Overnight calibration
		AT	08/01/2025 09:00	Manual calibration
		V	08/01/2025 10:00	Value validated. Partial hour due to manual calibration.
		BD	08/04/2025 02:00	Overnight calibration
		BD	08/06/2025 02:00	Overnight calibration
		BD	08/08/2025 02:00	Overnight calibration
		BD	08/11/2025 02:00	Overnight calibration
		BD	08/13/2025 02:00	Overnight calibration
		BD	08/15/2025 02:00	Overnight calibration
		BD	08/18/2025 02:00	Overnight calibration
		BD	08/20/2025 02:00	Overnight calibration
		BD	08/22/2025 02:00	Overnight calibration

Periods of Invalidation				
Month	**Parameter**	**Code**	**Date and Time**	**Description**
		BD	08/25/2025 02:00	Overnight calibration
		AM	08/26/2025 12:00	Filter change
		V	08/26/2025 13:00	Value validated. Partial hour due to filter change.
		BD	08/27/2025 02:00	Overnight calibration
		BD	08/29/2025 02:00	Overnight calibration
September	Ozone	BD	09/01/2025 02:00	Overnight calibration
		BD	09/03/2025 02:00	Overnight calibration
		BD	09/05/2025 02:00	Overnight calibration
		BD	09/08/2025 02:00	Overnight calibration
		BD	09/10/2025 02:00	Overnight calibration
		BD	09/12/2025 02:00	Overnight calibration
		BD	09/15/2025 02:00	Overnight calibration
		BD	09/17/2025 02:00	Overnight calibration
		BD	09/19/2025 02:00	Overnight calibration
		BD	09/22/2025 02:00	Overnight calibration
		BD	09/24/2025 02:00	Overnight calibration
		BD	09/26/2025 02:00	Overnight calibration
		BD	09/29/2025 02:00	Overnight calibration
		AM	09/30/2025 12:00	Filter change
		AV	09/30/2025 13:00	Power outage

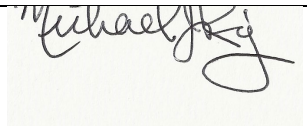
APPENDIX B2: CORRECTIVE ACTION REPORTS

CORRECTIVE ACTION REPORT NO.: 34

To **Dan Joseph**
From **Jake Zaragoza**
Copy to **Courtney Taylor and Kaitlyn Elkind**

Problem Identification		
Site (Location):	**Orchard**	
System or Instrumentation:	**Air Conditioning Unit**	
Estimated start date/time	**7/13/25**	
Problem identified by:	**Alex Clemments**	
Problem definition: • **Parameter (s) affected**	**Air conditioning unit had failed and was unable to maintain a controlled temperature in the shelter. Shelter temperatures went above 40 Celsius at least once. Nightly check impacted.** • **Shelter Temperature/Ozone**	
Planned corrective actions (if necessary):	**Replace AC unit with a new one**	
	Expected Completion Date:	**8/6/2025**

Problem Resolution		
Date corrective action taken:	**7/31/2025**	
Action taken by:	**Jake Zaragoza/Alex Clemments**	
Corrective action taken:	**Alex Clemments called Ramboll on 7/22 to inform them that the air conditioning system at Orchard was no longer cooling. On 7/22 shelter temperature was greater than 40 Celsius from 15:00-20:00 - ozone data during this period was invalidated. On 7/23 a nightly check was performed that failed critical criteria. A re-run of the calibration was not performed. On 7/24 troubleshooting for the system was attempted but the issues remained. Due to extreme temperatures in the forecast, the ozone system and calibrator were turned off on 7/24. On 7/31 the HVAC system was replaced and the ozone system and calibrator were turned back on and a brief zero-span-precision test was performed to confirm response. On 8/6 the failed check from 7/23 was discovered. Data will be invalidated back to the last good check (7/21).**	
Effectiveness of corrective actions:	☒ **Yes, it was resolved**	☐ **No, it was NOT resolved**

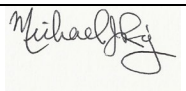
Corrective Action Report Author & Date	Signature
Prepared by: Jake Zaragoza **Date: 7/31/2025**	
QA Officer: Michael Ring **Date: 8/7/2025**	

CORRECTIVE ACTION REPORT NO.: 35

To **Dan Joseph**
From **Jake Zaragoza**
Copy to **Courtney Taylor and Kaitlyn Elkind**

Problem Identification		
Site (Location):	**Missile Site Park**	
System or Instrumentation:	**T400 Ozone**	
Estimated start date/time	**8/4/25**	
Problem identified by:	**Alex Leake**	
Problem definition: • **Parameter (s) affected**	**Span ozone check failed on 8/4 and 8/6. The issue was not caught until 8/6.** • **Ozone**	
Planned corrective actions (if necessary):	**Calibration on 8/6. Data fix on 8/11. Troubleshooting visit with a second system on 8/13.**	
	Expected Completion Date:	**9/30/2025**

Problem Resolution		
Date corrective action taken:	**8/6, 8/13, and 9/30 2025**	
Action taken by:	**Abe Dearden, Jake Zaragoza, & Bode Hoover**	
Corrective action taken:	**Alex Leake noted on his 8/6 daily check that the span check was outside of 7.1%. Upon further review, it was noted that the 8/4 span check was also outside of 7.1%. The T400 was calibrated on 8/6 to salvage data. On 8/13, ARS was contracted to challenge the analyzer, manifold, and calibrator with a second system. The Nafion sample conditioner was found to cause 5% ozone loss at span, so it was removed on 8/13. A new Nafion sample conditioner was installed on 9/30.**	
Effectiveness of corrective actions:	☒ **Yes, it was resolved**	☐ **No, it was NOT resolved**

Corrective Action Report Author & Date	Signature
Prepared by: Jake Zaragoza **Date: 7/31/2025**	
QA Officer: Michael Ring **Date: 10/16/2025**	

CORRECTIVE ACTION REPORT NO.: 36

To **Dan Joseph**
From **Jake Zaragoza**
Copy to **Courtney Taylor and Kaitlyn Elkind**

Problem Identification		
Site (Location):	**Missile Site Park**	
System or Instrumentation:	**T400 Ozone**	
Estimated start date/time	**5/23/25**	
Problem identified by:	**Jake Zaragoza/ARS**	
Problem definition: • **Parameter (s) affected**	**T700 level III transfer standard found with slope/offset values that did not match the certification sheet** • **Ozone and Ozone calibration system**	
Planned corrective actions (if necessary):	**The T700 slope/offset values were corrected as soon as the mismatch was discovered. Data invalidation not expected, but data to be flagged with 'Operational Deviation' flag.**	
	Expected Completion Date:	**September 10, 2025**

Problem Resolution		
Date corrective action taken:	**8/13 & 9/10/2025**	
Action taken by:	**Bode Hoover & Jake Zaragoza**	
Corrective action taken:	**The slope and offset of the calibrator were corrected as soon as the issue was discovered (8/13). After discussion with Mike Ring, it was determined that a Quality Control qualifier flag was needed for the Ozone data during the time the calibrator slope/offset was incorrect. The flag was applied on 9/10/2025 and was applied to all data between 5/23/2025 and 8/13/2025.**	
Effectiveness of corrective actions:	☒ **Yes, it was resolved**	☐ **No, it was NOT resolved**

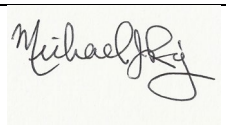
Corrective Action Report Author & Date	Signature
Prepared by: Jake Zaragoza **Date: 9/8/2025**	
QA Officer: Michael Ring **Date: 9/18/2025**	

CORRECTIVE ACTION REPORT NO.: 37

To **Dan Joseph**
From **Jake Zaragoza**
Copy to **Courtney Taylor and Kaitlyn Elkind**

Problem Identification		
Site (Location):	**Missile Site Park**	
System or Instrumentation:	**Solar Radiation**	
Estimated start date/time	**8/31/25**	
Problem identified by:	**Jake Zaragoza/Bode Hoover/Alex Clemments**	
Problem definition: • **Parameter (s) affected**	**Solar radiation sensor found covered in bird excrement** • **Solar radiation**	
Planned corrective actions (if necessary):	**The bird excrement was cleaned the day it was found. A data review will be performed to determine when it could have potentially occurred.**	
	Expected Completion Date:	**September 24, 2025**

Problem Resolution		
Date corrective action taken:	**9/9 & 9/24/2025**	
Action taken by:	**Bode Hoover & Jake Zaragoza**	
Corrective action taken:	**The bird excrement was cleaned as soon as it was discovered on 9/9. A data review was performed on 9/24 to attempt to determine when the impacts began. After review of solar radiation data from all three sites, and precipitation data from Missile Site Park, it was determined that the impacts likely began on 8/31. Data was invalidated from 8/31 at 01:00 to 9/9 at 14:00.**	
Effectiveness of corrective actions:	☒ **Yes, it was resolved**	☐ **No, it was NOT resolved**

Corrective Action Report Author & Date	Signature
Prepared by: Jake Zaragoza **Date: 9/24/2025**	
QA Officer: Michael Ring **Date: 9/25/2025**	

APPENDIX C: Q3 2025 SITE VISITATION LOGS

Missile Site Park Site Access Log								
Name	**Date**	**Arrival**	**Departure**	**Last Filter change**		**Pump off**	**Pump on**	**Notes**
				NOx	Ozone			
Zaragoza (remote)	7/9/2025	10:54	11:06					Span testing ozone analyzer
Zaragoza	7/9/2025	13:21	16:14					On site to troubleshoot ozone analyzer. Gases offline from 13:22 to 16:12. As is span result for ozone is 377. Short inlet/cal line span result 387. New calibration line (similar to original configuration) span result 377. Bypass Nafion (new cal line; basically original configuration) span result 384. Leak check at ozone analyzer = 0 cc/min flow and 1.6 inHg. Leak check upstream of nafion/prior to NOx/O3 'T' fitting = 0 cc/min and 1.6 inHg. Nafion left in place, only change was to calibration line, no impacts to gas analyzers.
Clemments	7/29/2025	13:40	14:15	7/29/2025	7/29/2025	14:04	14:08	Filter changes for NOX and O3, NADP precipitation and ammonia samples retrieved and set up. Poured water into precipitation bucket to test, good.
Zaragoza (remote)	8/6/2025	9:04	11:11					Ozone analyzer calibration after nightly span check failure. As found slope 1.010 as found offset -1.8. As left slope 1.095 as left offset -2.9. No as found check performed (values only recorded) since failure occurred days prior.
Zaragoza/Wenrick	8/13/2025	7:34	11:45					On site to troubleshoot ozone and ozone calibration system. Gases offline 7:46 to 11:43. Ozone Nafion drier removed after it was found to cause 5% ozone loss.
Zaragoza (remote)	8/13/2025	12:34	14:58					Calibration and post-maintenance multipoint for ozone. Gases offline from 12:34 to 14:58
Clemments	8/26/2025	13:32	14:05	8/26/2025	8/26/2025	13:55	14:00	Filter changes for NOX & O3. NADP precipitation duties.
Hoover (remote)	9/10/2025	8:57	9:56					re-run O3 ZSP. Zero (T400 = 0.15, T700 actual = -1.6, T700 target = 0), span (T400 = 402.69, T700 actual =400.0, T700 target = 400), precision (T400 = 60.86, T700 actual = 60.1, T700 target = 60). Logger time. Put back into standby at 9:54
Dearden (remote)	9/15/2025	9:01	9:06					Manual calibration attempt.
Zaragoza/Hoover	9/19/2025	11:11	13:40					On site to troubleshoot zero air generator (ZAG). Output capped and ZAG unable to build to 30 PSI/compressor did not turn off between 11:14-11:25. Compressor dead head tested > 200 PSI. Existing 4 way valve tested, both vents read 0 LPM in their closed positions and ~6 LPM in their open position. Open normally reads greater than 10 LPM. New 4 way valve installed and compressor still does not turn off. It was noted with the new 4 way valve that the liquid drain valve is constantly venting despite normal operation from the motherboard. Original 4 way valve re-installed, ZAG left off while new liquid drain valve is ordered. Left site at 13:40.
Zaragoza/Hoover	9/25/2025	11:50	12:30					On site to troubleshoot zero air generator (ZAG). Replaced drain valve. Manual zero for O3 (~5 min) test from 12:23 to 12:28 logger time
Hoover (remote)	9/25/2025	13:30	13:55					Manual O3 ZSP at MSP. Zero started at 1:30 PM logger time, Span started at 1:39 PM logger time, Precision started at 1:48 PM logger time, Enter Standby at 1:55 PM logger time
Hoover (remote)	9/30/2025	7:00	7:30					Manual O3 ZSP. Zero started at 7:01 AM logger time (Logger = 0.16, T700 actual = 0.2), Span started at 7:08 AM logger time (Logger = 405.34, T700 actual = 398.4), Precision started at 7:20 AM logger time (Logger = 62.80. T700 actual= 60.8), Standby started at 7:30 AM logger time
Hoover/Zaragoza	9/30/2025	9:00	10:50					Install sample conditioner on O3. Ozone down from 9:10 to 9:49. NOx down from 9:12-9:49
Hoover (remote)	9/30/2025	10:35	11:56					Multi-point O3 calibration. Computer is scheduled to restart on 10/6
Clemments	9/30/2025	13:40	14:02	9/30/2025	9/30/2025	13:51	13:55	Filter changes, NADP precip operations.

Hereford Site Access Log							
Name	**Date**	**Arrival**	**Departure**	**Last Filter change**	**Pump off**	**Pump on**	**Notes**
				Ozone			
Clemments	7/31/2025	13:47	14:03	7/31/2025	13:51	13:56	Filter and Desiccant change
Zaragoza (Remote)	8/15/2025	11:00	11:55				Re-run ZSP: Zero: .783. Span (T400): 392.58 (T703) 396.2; Precision (T400): 59.54, T703: 61.5 (values are instantaneous, file transfer for logged data failed)
Clemments	8/28/2025	11:45	12:00	8/28/2025	11:49	11:55	Filter and Desiccant change
Hoover (Remote)	9/30/2025	6:51	7:02				Started a Zero check inadvertently and then canceled it
Garcia	9/30/2025	10:25	10:45	9/30/2025	10:32	10:39	Desiccant and filter change

Orchard Site Access Log							
Name	**Date**	**Arrival**	**Departure**	**Last Filter change**	**Pump off**	**Pump on**	**Notes**
				Ozone			
Clemments	7/1/2025	11:30	12:15				NADP pr[1]
Clemments	7/24/2025	11:55	12:50		-	-	Filter and Desiccant changed, NADP sample retrieved.
Zaragoza/Clemments	7/31/2025	9:00	11:49	7/31/25	-	12:20	On site to install new AC unit and turn on ozone analyzer. Filter change performed while analyzer still off.
Dearden (Remote)	7/31/2025	12:40	14:10				Manual ZSP cal after site visit. Ozone offline
Dearden (Remote)	8/1/2025	8:17	9:05				Manual ZSP, ozone offline.
Clemments	8/26/2026	11:45	12:20	8/26/25	12:09	12:15	Filter, Desiccant change and NADP duties.
Clemments	9/30/2025	11:37	12:25	9/30/25	12:02	-	Power went out during changing of filters and desiccant, Pump was plugged back in at 12:18 prior to power returning. Filter and Desiccant change as well as normal NADP precip duties.

[1]Notes taken as is from the original site log.

APPENDIX D: Q3 2025 CALIBRATION STATISTICS

APPENDIX D: Q3 2025 CALIBRATION STATISTICS

CONTENTS

Figures

Tables

D.1 PREFACE

Appendix D of the Quality Assurance Handbook Volume II (https://www.epa.gov/sites/default/files/2020-10/documents/app_d_validation_template_version_03_2017_for_amtic_rev_1.pdf) specifies the frequency and allowable ranges of the one-point quality control (precision), zero, and span checks for ozone and NO/NO_2/NOx, which are based on the Code of Federal Regulations (CFR). These allowable ranges are mostly percent differences between a measured point and the audit point. At each site, the measured point was taken as a 3-minute average of a stable analyzer reading while receiving calibration gas. The audit point is a preset calibration target that the on-site calibrators produce. For both ozone and NO/NOx, the precision check is 60 ppb and the span check is 400 ppb. For NO_2, the target output concentrations from the calibrator are 48 ppb and 160 ppb for precision and span checks, respectively. Since the calibrator only indirectly calculates NO_2 concentration, the actual target NO_2 output is calculated as the difference in NO between the gas phase titration zero (GPTZ) and the gas phase titration (GPT) phases. The analyzer is then challenged against these actual target NO_2 concentrations. Each figure below highlights the percent difference between the measured point and the audit point, with the upper and lower lines representing the allowable upper and lower limits. NO_2 has an additional requirement for calculation of the converter efficiency in converting NO_2 to NO. Each converter efficiency check is plotted for it.

Additionally, each table below represents the results of the calculations detailed in 40CFR58, Appendix A, Section 4 'Calculations for Data Quality Assessments' (https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-58). They are provided only for informational purposes.

D.2 MISSILE SITE PARK SITE

Ozone (O_3)

Figure D - 1 and **Figure D - 2** below show the calibration span and precision percent differences for ozone at the Missile Site Park site. Between August 1st and August 6th data was invalidated because of poor calibration results caused by an issue with the Nafion sample conditioner. The Nafion conditioner was removed on August 13th, and a new one was installed on September 30th. Regularly scheduled calibrations did not occur between September 14th and 15th and September 17th and 25th due to an issue with the zero-air generator (ZAG). A manual calibration was performed on September 25th. Each check is within the upper and lower bounds specified in Appendix D of the Quality Assurance Handbook Volume II. **Table D - 1** highlights the assessment statistics detailed in 40CFR58, Appendix A, Section 4.

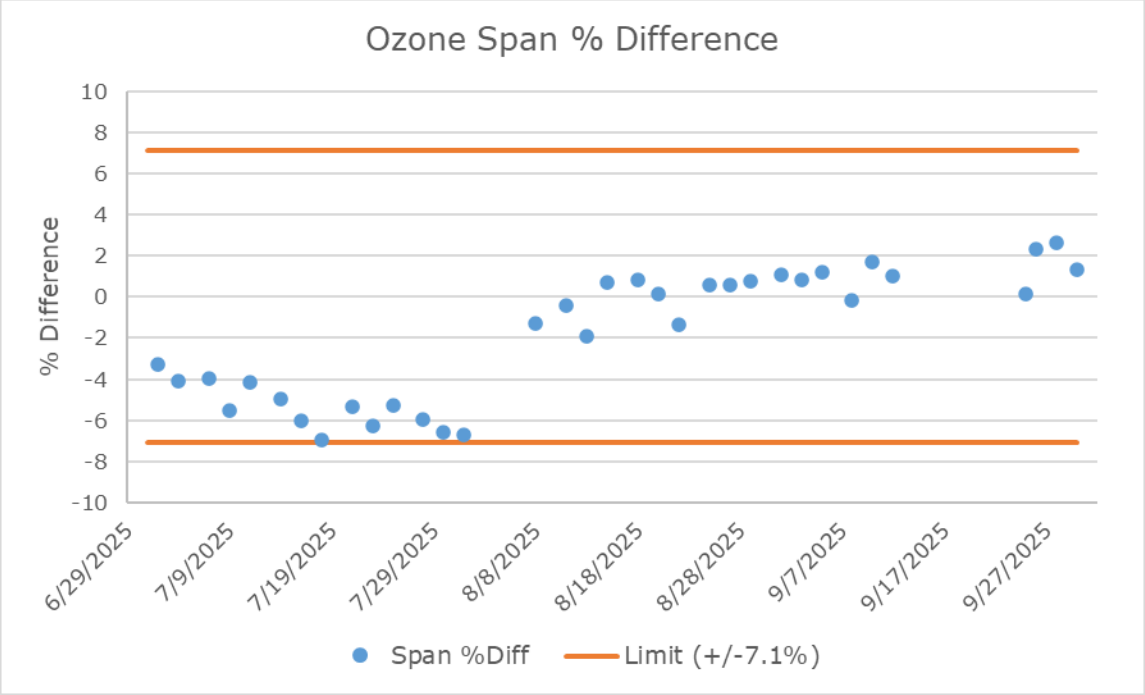


Figure D - 1. 2025 Q3 Calibration span percent difference for O_3 at Missile Site Park.

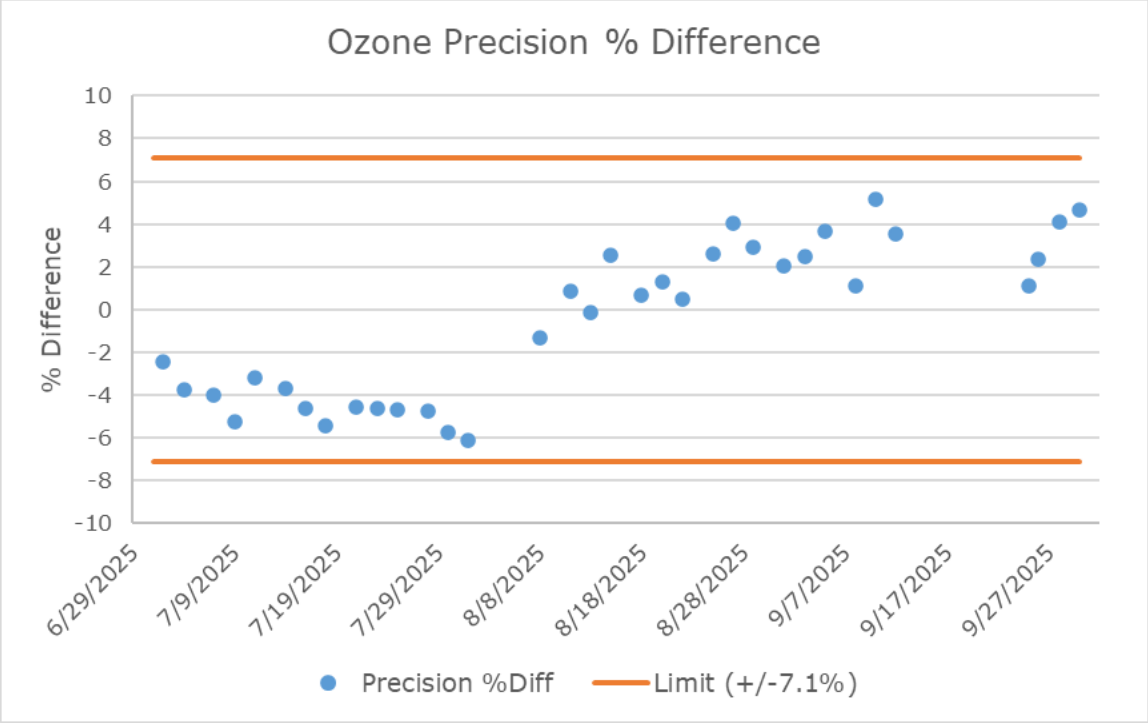


Figure D - 2. 2025 Q3 Calibration precision percent difference for O_3 at Missile Site Park.

Table D - 1. Summary of 2025 Q3 calibration statistics for O_3 at Missile Site Park.

Formula	Precision	Span
STDEV	3.64	3.16
Count	34	34
Chi^2, 0.1, n-1	23.11	23.11
CV	4.35	3.78
Bias	3.72	3.50
Bias (+/-/U)	U	U
AB	3.23	2.83
AS	1.67	2.33
$t_{0.95}$, n-1	1.69	1.69
25^{th}	-4.39	-5.19
75^{th}	2.51	0.83

Nitric Oxide (NO)

Figure D - 3 and **Figure D - 4** below show the calibration span and precision percent differences for NO at the Missile Site Park site. Regularly scheduled NO/NO_2/NOx calibrations did not occur on September 14^{th} and between September 18^{th} and 25^{th} due to the issue with the zero-air generator. Each check is within the upper and lower bounds specified in Appendix D of the Quality Assurance Handbook Volume II. **Table D - 2** highlights the assessment statistics detailed in 40CFR58, Appendix A, Section 4.

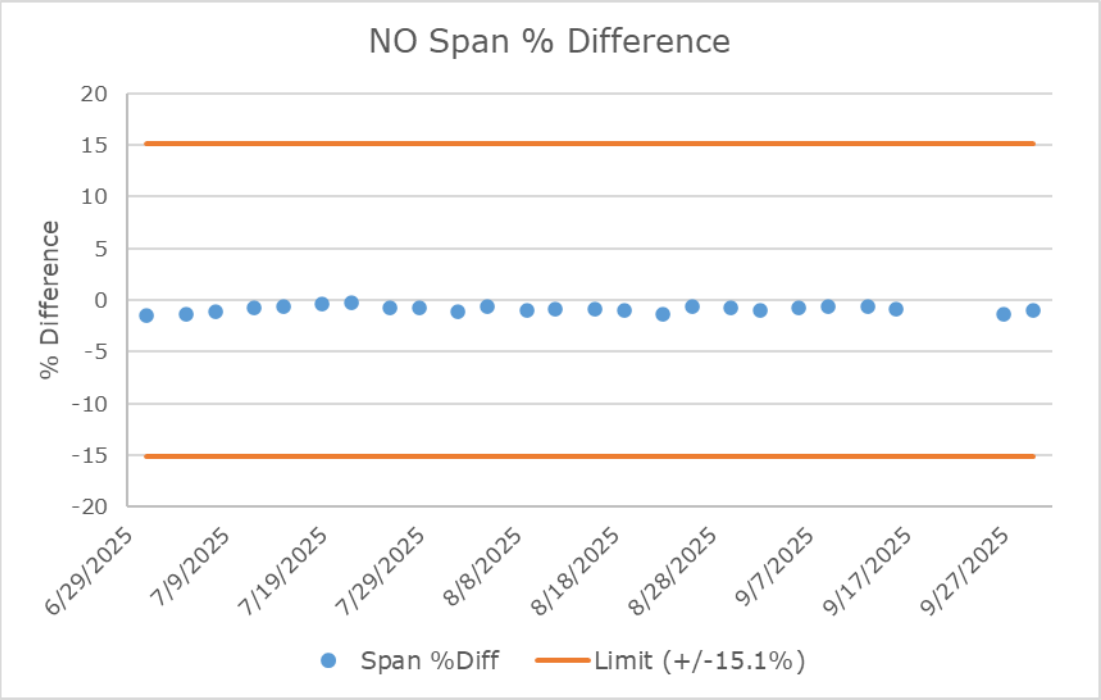


Figure D - 3. 2025 Q3 Calibration span percent difference for NO at Missile Site Park.

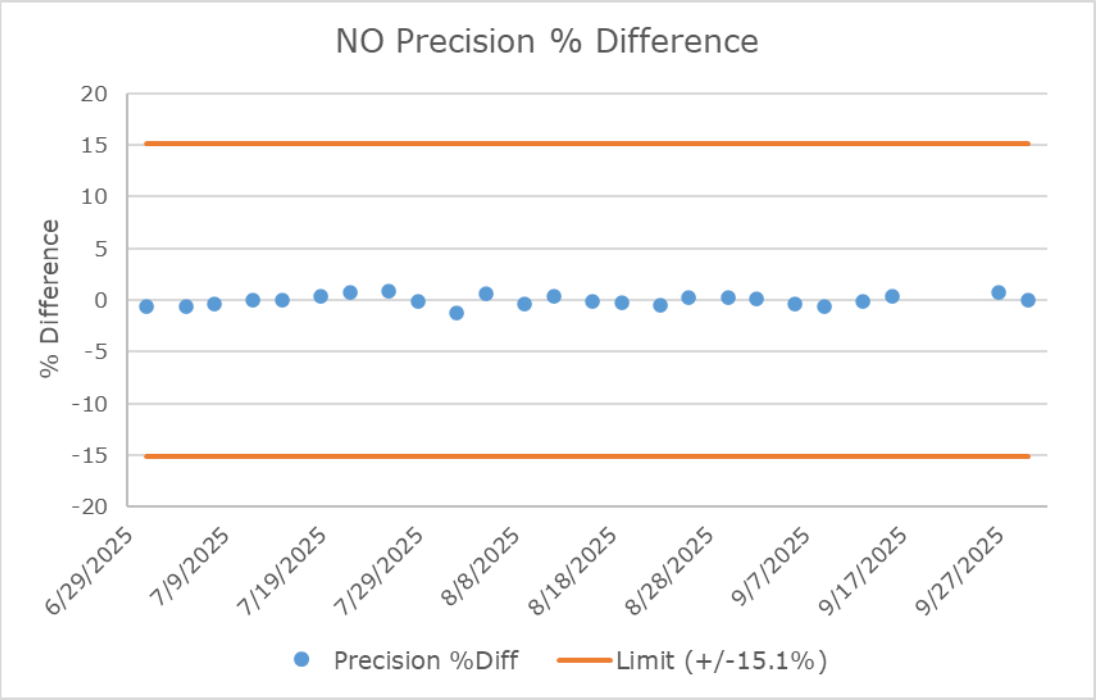


Figure D - 4. 2025 Q3 Calibration precision percent difference for NO at Missile Site Park.

Table D - 2. Summary of 2025 Q3 calibration statistics for NO at Missile Site Park.

Formula	Precision	Span
STDEV	0.51	0.30
Count	25	25
Chi^2, 0.1, n-1	15.66	15.66
CV	0.63	0.37
Bias	0.50	0.96
Bias (+/-/U)	U	-
AB	0.40	0.86
AS	0.30	0.30
$t_{0.95}$, n-1	1.71	1.71
25^{th}	-0.39	-0.96
75^{th}	0.33	-0.66

Nitrogen Dioxide (NO_2)

Figure D - 5 below shows the converter efficiency (CE) during both precision (shown in blue) and span (shown in gold) calibrations for NO_2. CE has been calculated based on the latest published federal guidance[1]. The federal record requires only a minimum CE rate of 96%, while the upper limit of 104.1% is an EPA recommendation[2] only. Note that the data shown in **Figure D - 5** represent estimates of CE determined from a 1-point precision or span NO_2 gas phase titration (GPT) level only. Furthermore, gas flow rates are not available during the single-point GPT checks so that the correction factor for NO_2 impurity cannot be included in the computation. In contrast, the CE values determined from a multi-point check are computed via a linear fit across multiple GPT points, and flow rates are available so that the impurity correction can be included. The CE determined during the multi-point quarterly calibration checks is therefore expected to be a more accurate assessment of the CE than the values determined during the single-point quality control checks.

Figure D - 6 and **Figure D - 7** below show the calibration percent difference for NO_2 during span and precision calibrations, respectively. Regularly scheduled NO/NO_2/NOx calibrations did not occur on September 14^{th} and between September 18^{th} and 25^{th} due to the issue with the zero-air generator. Each calibration check was within the upper and lower bounds specified in Appendix D of the Quality Assurance Handbook Volume II. **Table D - 3** highlights the assessment statistics detailed in 40CFR58, Appendix A, Section 4.

[1] Converter efficiency calculations follow 40CFR Part 50 Appendix F, Sections 1.5.10 and 2.4.10.

[2] EPA-454/B-17-001, Quality Assurance Handbook for Air Pollution Measurement Systems Volume II: Ambient Air Quality Monitoring Program Appendix D, March 2017.

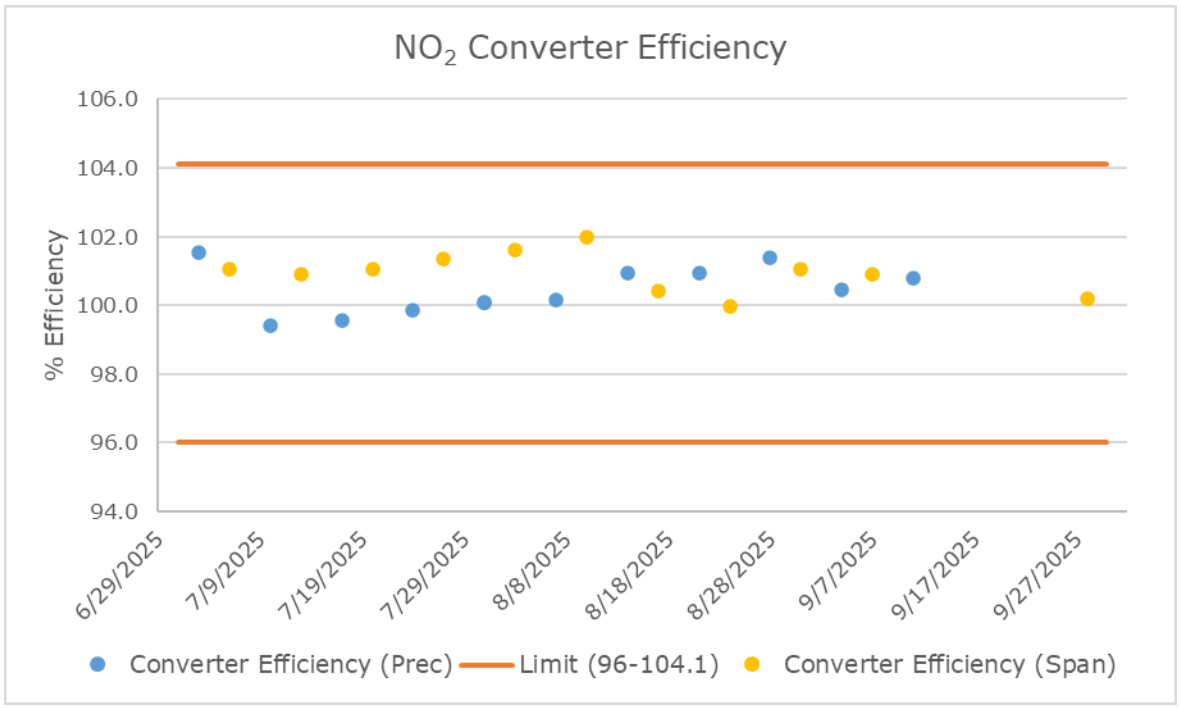


Figure D - 5. 2025 Q3 Converter efficiency for NO_2 at Missile Site Park.

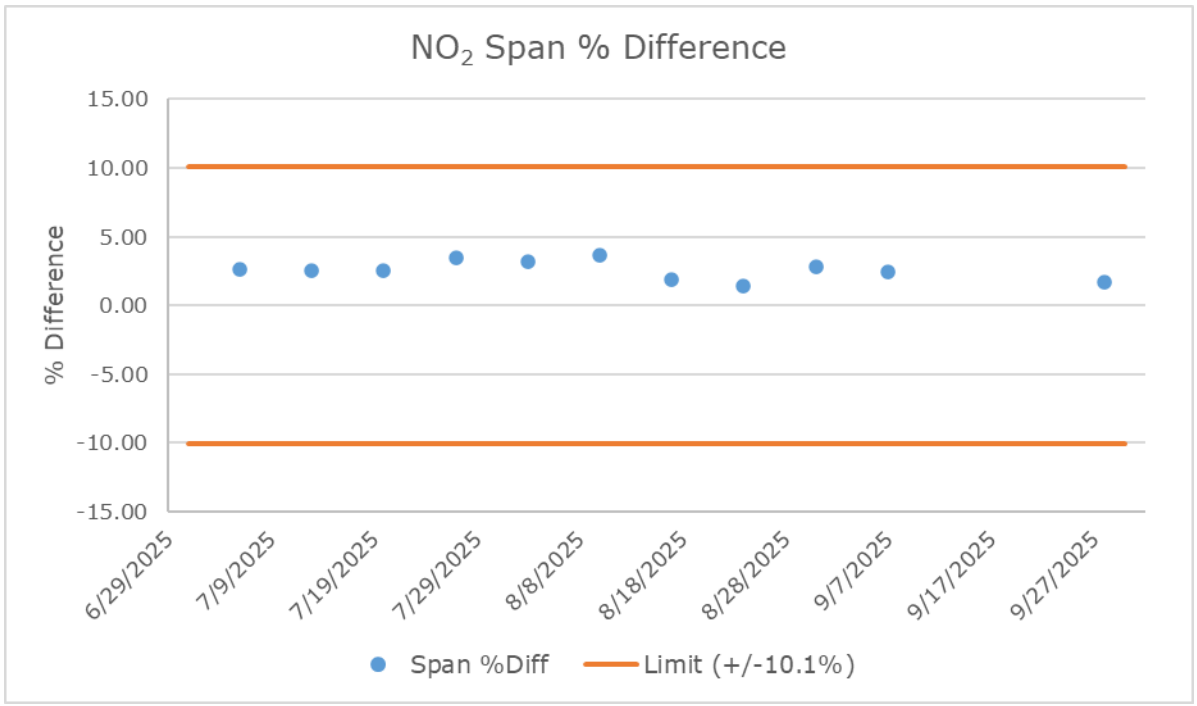


Figure D - 6. 2025 Q3 Calibration span percent difference for NO_2 at Missile Site Park.

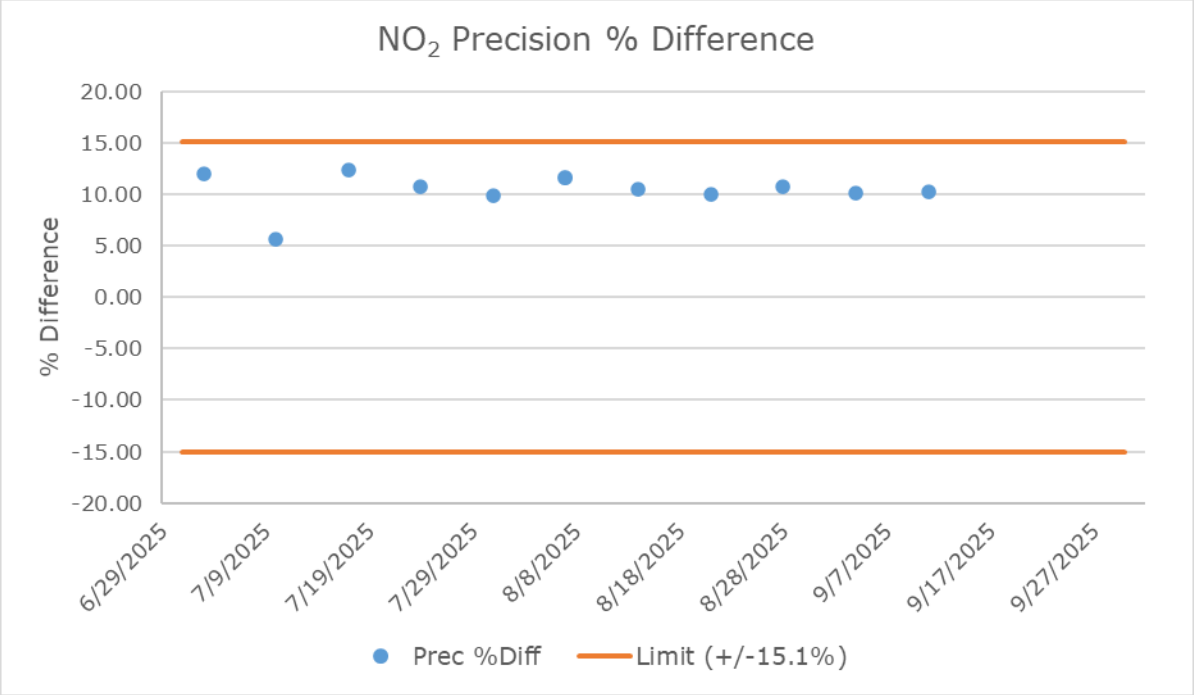


Figure D - 7. 2025 Q3 Calibration precision percent difference for NO_2 at Missile Site Park.

Table D - 3. Summary of 2025 Q3 calibration statistics for NO_2 at Missile Site Park.

Formula	Precision	Span
STDEV	1.78	0.70
Count	11	11
Chi^2, 0.1, n-1	4.87	4.87
CV	2.55	1.00
Bias	11.29	2.95
Bias (+/-/U)	+	+
AB	10.31	2.56
AS	1.78	0.70
$t_{0.95}$, n-1	1.81	1.81
25^{th}	10.03	2.17
75^{th}	11.09	2.98

Nitrogen Oxides (NOx)

Figure D - 8 and **Figure D - 9** below show the calibration span and precision percent differences for NOx at the Missile Site Park site. Regularly scheduled $NO/NO_2/NOx$ calibrations did not occur on September 14th and between September 18th and 25th due to the issue with the zero-air generator. Each check was within the upper and lower bounds specified in Appendix D of the Quality Assurance Handbook Volume II. **Table D - 4** highlights the assessment statistics detailed in 40CFR58, Appendix A, Section 4.

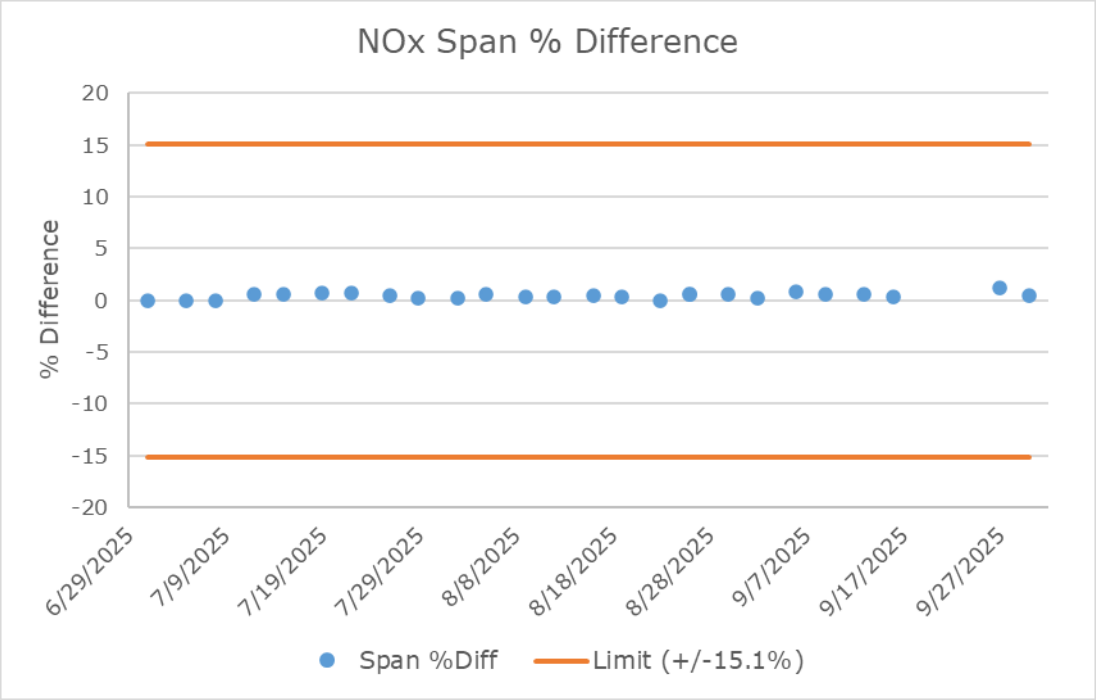


Figure D - 8. 2025 Q3 Calibration span percent difference for NOx at Missile Site Park.

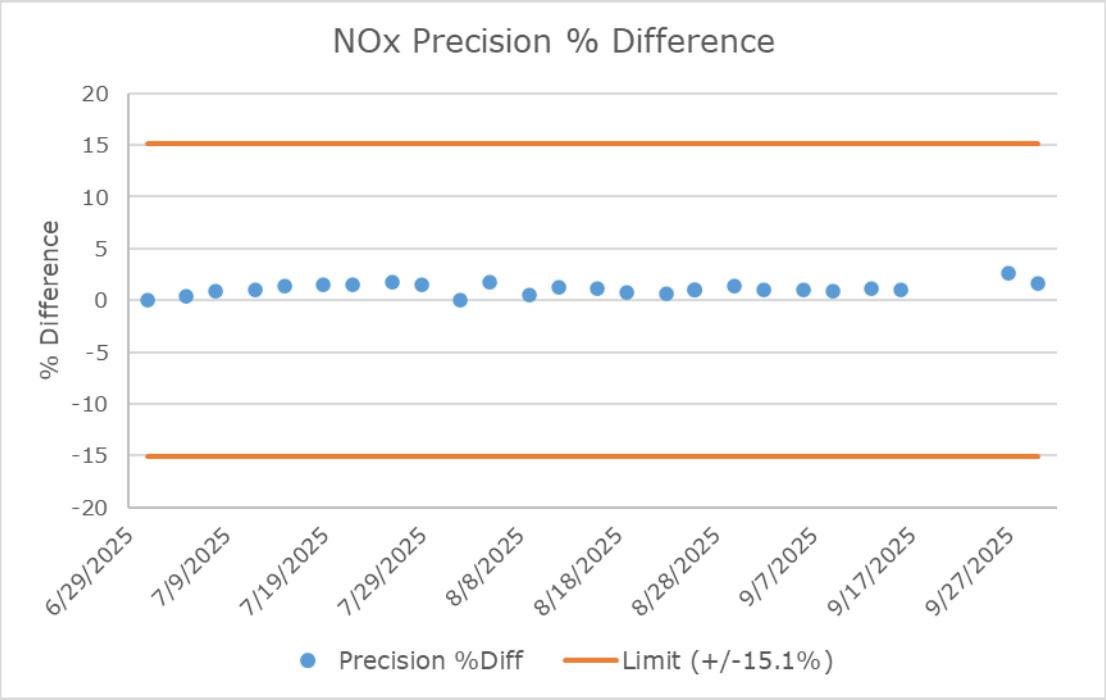


Figure D - 9. 2025 Q3 Calibration precision percent difference for NOx at Missile Site Park.

Table D - 4. Summary of 2025 Q3 calibration statistics for NOx at Missile Site Park.

Formula	Precision	Span
STDEV	0.58	0.31
Count	25	25
Chi^2, 0.1, n-1	15.66	15.66
CV	0.72	0.39
Bias	1.32	0.56
Bias (+/-/U)	+	+
AB	1.12	0.46
AS	0.57	0.28
$t_{0.95}$, n-1	1.71	1.71
25^{th}	0.86	0.27
75^{th}	1.51	0.61

D.3 HEREFORD SITE

Ozone (O_3)

Figure D - 10 and **Figure D - 11** below show the calibration span and precision percent differences for ozone at the Hereford site. A manual calibration was performed on August 15th to replace the regularly scheduled automatic calibration. Each check is within the upper and lower bounds specified in Appendix D of the Quality Assurance Handbook Volume II. **Table D - 5** highlights the assessment statistics detailed in 40CFR58, Appendix A, Section 4.

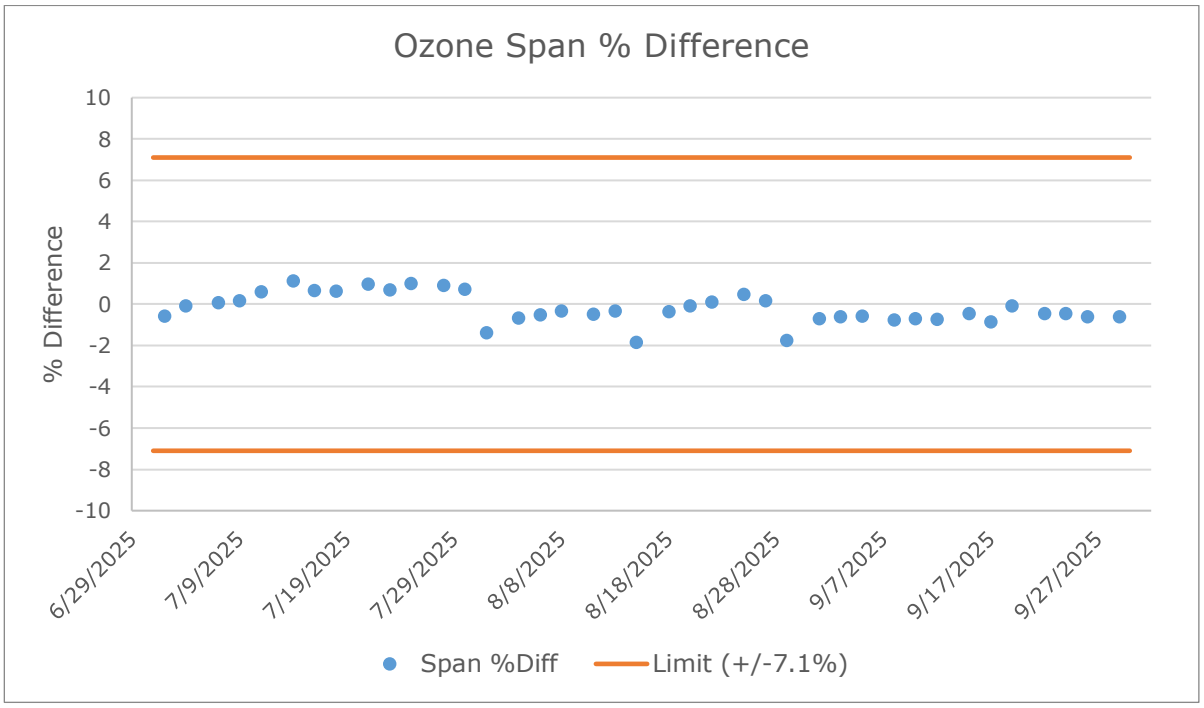


Figure D - 10. 2025 Q3 Calibration span percent difference for O_3 at Hereford.

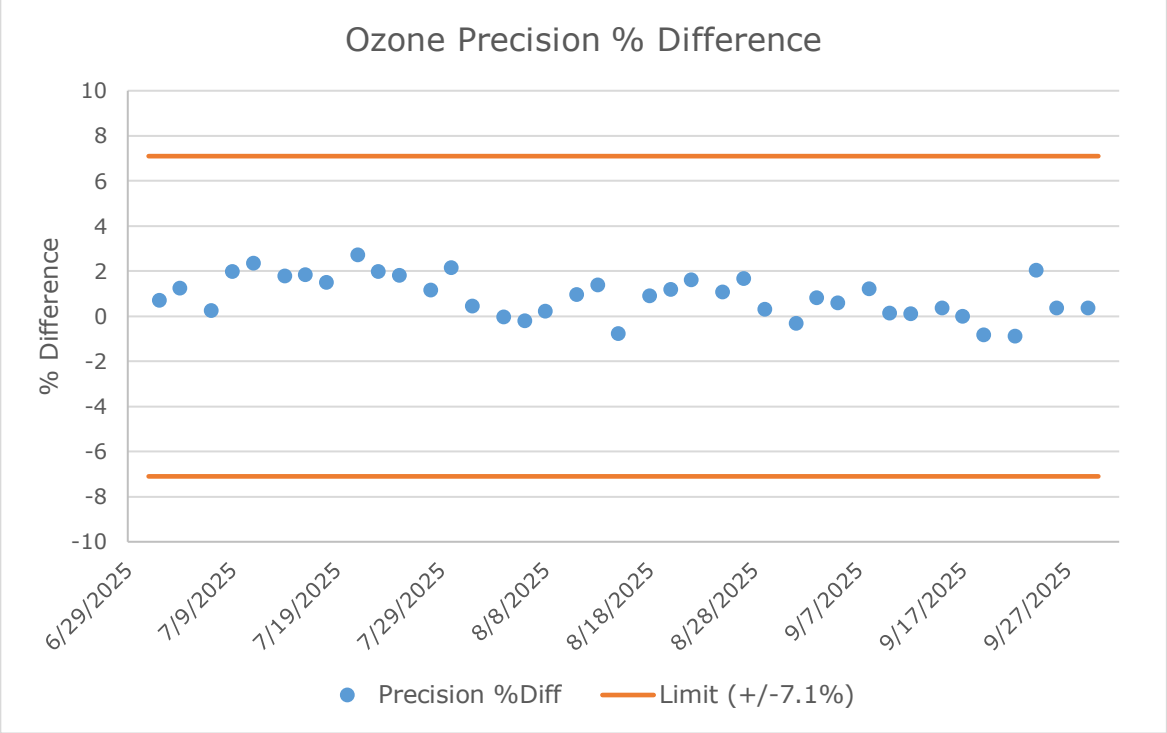


Figure D - 11. 2025 Q3 Calibration precision percent difference for O_3 at Hereford.

Table D - 5. Summary of 2025 Q3 calibration statistics for O_3 at Hereford.

Formula	Precision	Span
STDEV	0.92	0.73
Count	39	39
Chi^2, 0.1, n-1	27.34	27.34
CV	1.08	0.86
Bias	1.24	0.73
Bias (+/-/U)	+	U
AB	1.04	0.62
AS	0.74	0.41
$t_{0.95}$, n-1	1.69	1.69
25^{th}	0.25	-0.61
75^{th}	1.65	0.33

D.4 ORCHARD SITE

Ozone (O_3)

Figure D - 12 and **Figure D - 13** below show the calibration span and precision percent differences for ozone at Orchard. Data was invalidated between July 21st and 31st due to an issue with the air conditioning unit in the enclosure. After the air conditioning unit was replaced, manual calibrations took place on July 31st and August 1st. Each check is within the upper and lower bounds specified in Appendix D of the Quality Assurance Handbook Volume II. **Table D - 6** highlights the assessment statistics detailed in 40CFR58, Appendix A, Section 4.

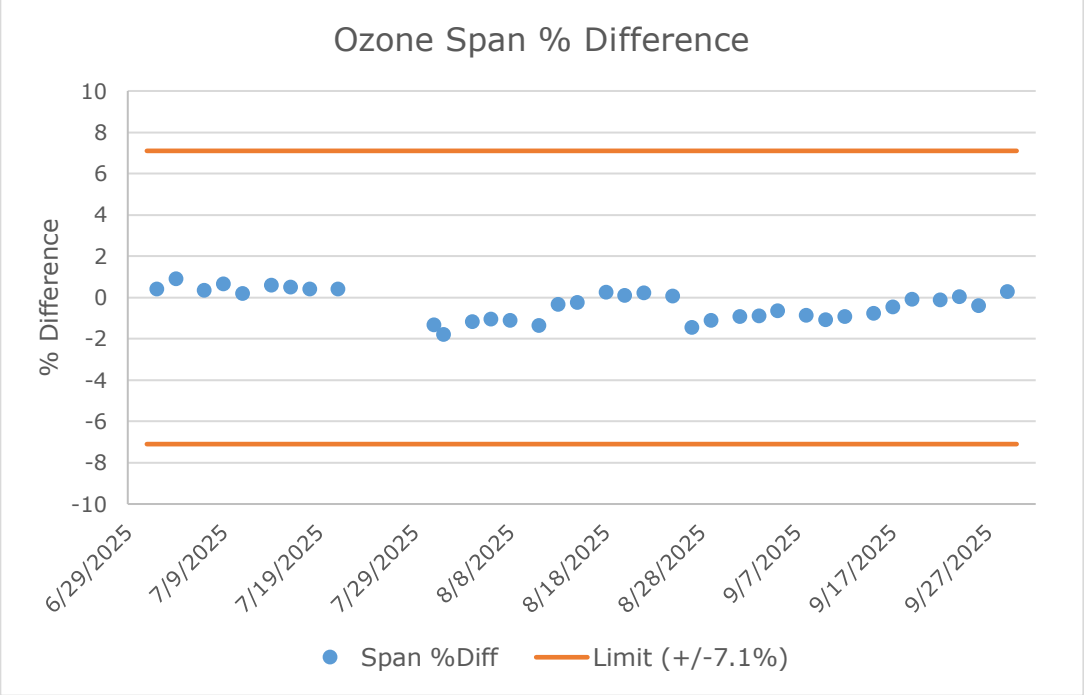


Figure D - 12. 2025 Q3 Calibration span percent difference for O_3 at Orchard.

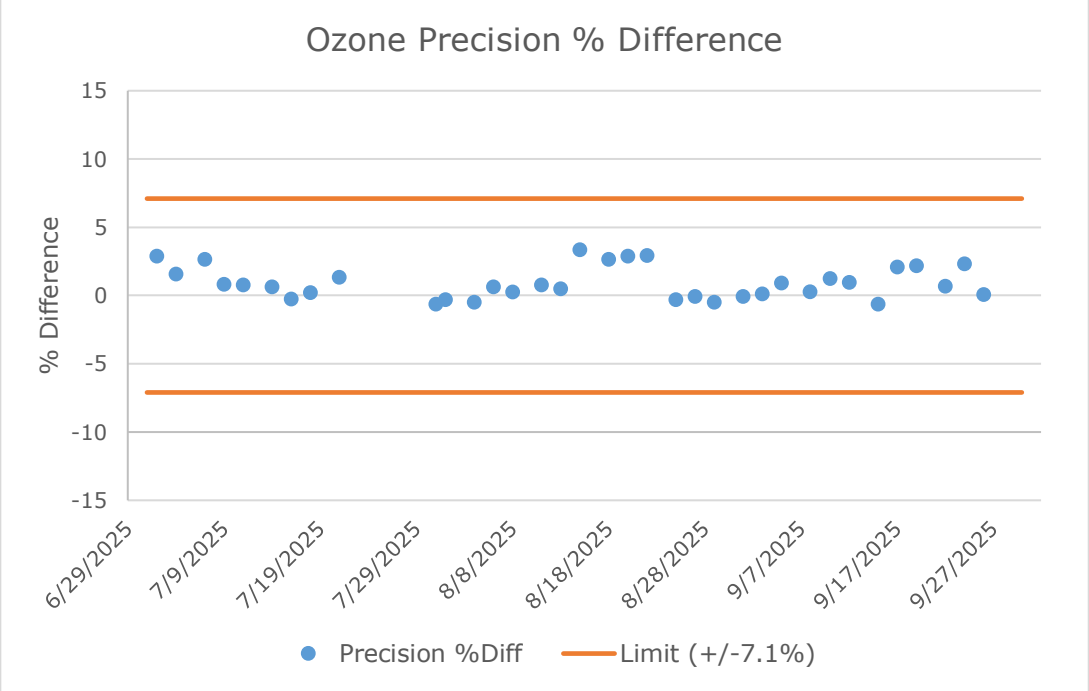


Figure D - 13. 2025 Q3 Calibration precision percent difference for O_3 at Orchard.

Table D - 6. Summary of 2025 Q3 calibration statistics for O_3 at Orchard.

Formula	Precision	Span
STDEV	1.19	0.72
Count	36	36
Chi^2, 0.1, n-1	24.80	24.80
CV	1.41	0.85
Bias	1.43	0.78
Bias (+/-/U)	+	U
AB	1.15	0.65
AS	1.02	0.45
$t_{0.95}$, n-1	1.69	1.69
25^{th}	0.04	-0.95
75^{th}	2.12	0.26