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WELD COUNTY MONITORING NETWORK

AIR QUALITY AND METEOROLOGICAL MONITORING DATA: 1ST 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 1 2025 MONITORING HIGHLIGHTS

Data Completeness

- All data completeness goals were met for all parameters at all three sites.

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 51 ppb, 54 ppb, and 53 ppb for MSP, Hereford, and Orchard respectively.

- **Spatial trends:** Consistent with quarter 1 (Q1) in previous years, all three sites measured very similar, relatively low, ozone concentrations. In fact, the 1st highest MDA8 for all three sites was the same (57 ppb).

- **Annual trends:** Measured ozone concentrations at all sites are similar to prior years. For comparison, at this time last year, the 4th MDA8 at all three sites were also relatively low at 52 ppb, 51 ppb, and 52 ppb for MSP, Hereford, and Orchard respectively.

- **Exceedances:** None. Year-to-date, measured concentrations at all sites are well below the 2008 and the 2015 ozone standard.

Nitrogen Dioxide (NO_2)

- **Values:** Q1 concentrations at MSP are well below federal annual and 1-hour health-based standards.

- **Annual trend:** Annual mean NO_2 value to date is 7.7 ppb, slightly lower than in Q1 2024.

Quarterly Events

- **Climate trends:** Q1 2025 was cooler and wetter than normal with temperatures in Weld County approximately 2°F cooler and 1.5 more inches of precipitation.[1]

- **Summary of non-routine site visits:** MSP had 3 in person visits and 11 virtual visits to both troubleshoot parts of the gas analyzer systems and the precipitation gauge. Orchard had 3 virtual visits to troubleshoot the gas analyzer system.

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

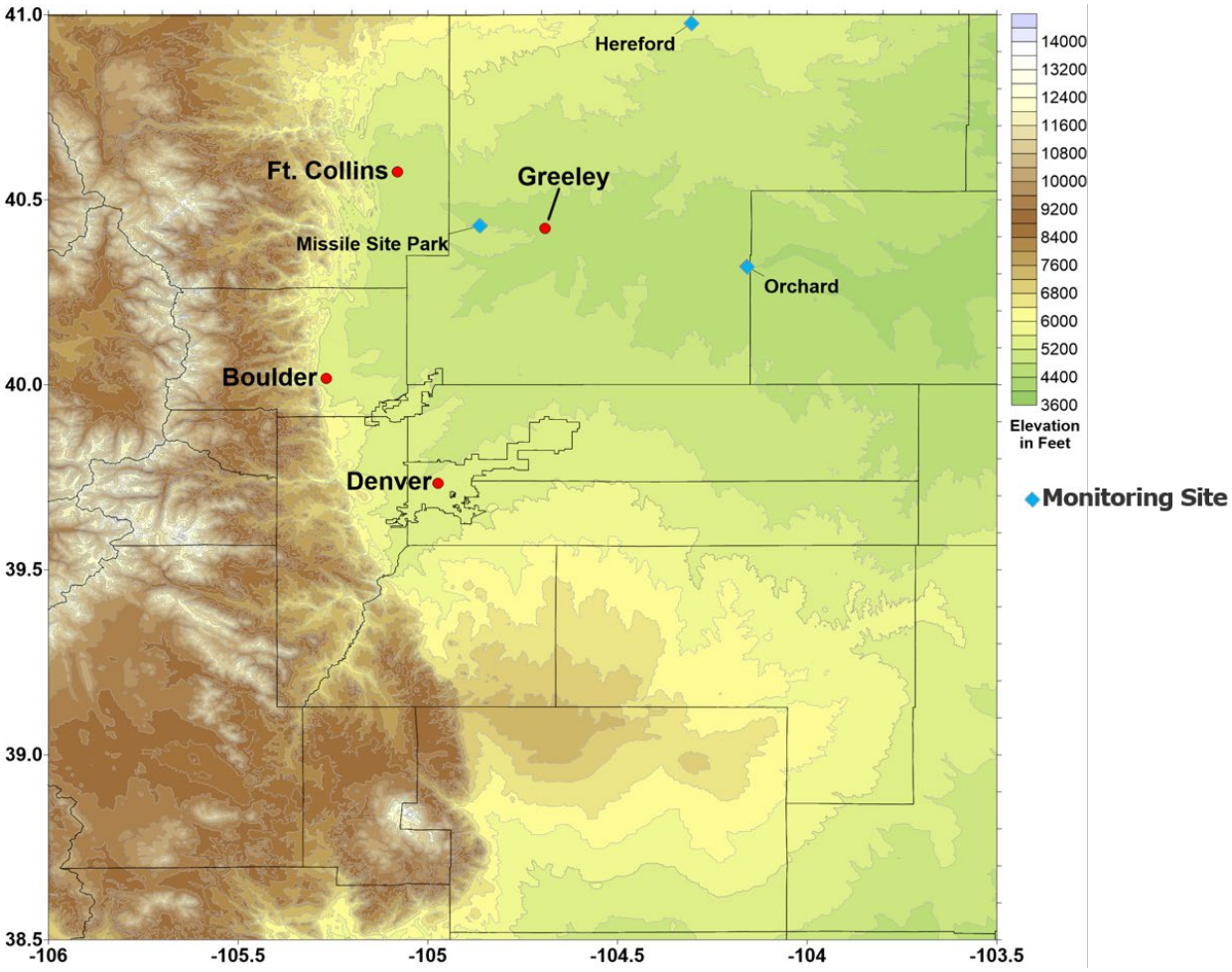

Figure 1. Weld County Monitoring Station Locations

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 an air monitoring network assessment conducted for Weld County,[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 1st quarter of 2025 (Q1 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 January 1, 2025 through March 31, 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 Q1 2025 data are 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 Q1 2025 were all within normal ranges for the area and season. At all three stations, average temperatures were coldest during January and warmest during March. Average solar radiation gradually increased as the quarter progressed at all three sites while maximum solar radiation occurred in March. Total precipitation peaked in March at all three sites. Continuous gaseous pollutant measurements for Q1 2025 indicate that all three stations experienced relatively low ozone concentrations. During Q1 2025 no site exceeded the 2008 or 2015 AAQS. The maximum 8-hour average O_3 concentration at all three sites was 57 ppb on March 12th. Concentrations remained below the AAQS values for NO_2. At MSP, the highest hourly average NO_2 recorded during Q1 2025 was 42.9 ppb on January 8th.

It is important to note that O_3 and NO_2 measurements have now been collected for three years, enabling measurements to be compared to AAQS. The measured concentrations are compared to AAQS for informational purposes in Chapter 4 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;
- 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.

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 2 and **Table 3** 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), September 18th 2023. Available by request.

[8] Id.

Table 2. 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, µg/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 3. 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

Measurement	Count	Tower Location (m)	Manufacturer	Model	Serial Number	Accuracy	Range	Description

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] An audit was performed in Quarter 4 of 2024, and a subsequent audit will be performed in Quarter 2 of 2025. The Quarter 4 2024 calibration and independent audit results are available in the 2024 Annual Report Appendix B.

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 all three stations three times per week. For the NO_x analyzer at MSP, calibration checks include

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

[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 April 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 April 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.

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 Q1 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 Q1 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 4** for all continuous monitoring systems. During Q1 2025, data losses occurred from regularly scheduled gas calibrations (471 hours), power outages (11 hours), manual gas calibrations (12 hours), invalidation when quality assurance requirements were not met (1158 hours), instrument maintenance (28 hours), and multi-point calibrations (110).

Notable events that occurred during the quarter that resulted in data loss include when MSP's NO_x analyzer experienced a shift in response that led to data invalidation between January 25th through February 7th. Despite this data loss, all data completeness goals were met at each of the three sites during Q1 2025.

Figure 6 shows the extended period during which the MSP NO_x analyzer did not meet quality assurance requirements from January 25th through February 7th, and again from February 12th through

[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 April 2025.

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

February 14th. **Table 4** shows that data completeness requirements for MSP NO_2 were met during Q1 2025 despite periods of invalid data.

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 5** presents the instrument accuracy and precision targets and the accuracy and precision achieved by the instruments deployed at each station during the most recent semi-annual calibrations in Q4 2024. No scheduled calibration checks took place during Q1 2025; however, five multi-point calibrations occurred at MSP as to inform instrument troubleshooting, and ultimately results met quality assurance requirements. Results can be found in **Appendix A**.

Table 4. 1st Quarter 2025 Data Completeness for Continuous Measurement Devices

Measurement	Time Period	Completeness Target	Site Completeness				Target Met? (Y/N)
			Jan	Feb	Mar	Q1 2025	
Missile Site Park							
NO_2[1]	Quarterly	≥75%	69%	64%	94%	76%	Yes
NO_x, NO[1]	N/A	N/A	69%	64%	94%	76%	N/A
O_3[1]	O_3 Season	≥90%	97%	89%	100%	96%	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
Hereford							
O_3[1]	O_3 Season	≥90%	100%	100%	100%	100%	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%	100%	100%	100%	100%	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

Measurement	Time Period	Completeness Target	Site Completeness				Target Met? (Y/N)
			Jan	Feb	Mar	Q1 2025	
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:

[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.

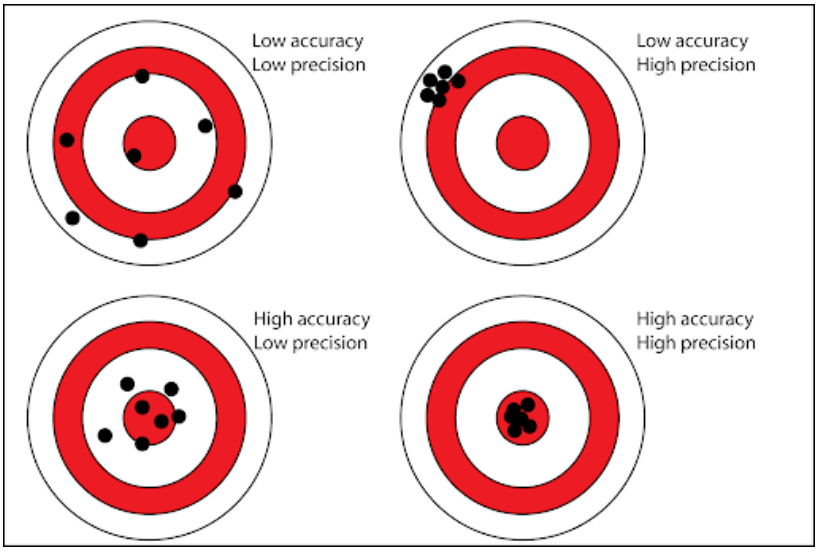

Figure 2. Graphical Representation of Accuracy and Precision

Table 5. 4th Quarter 2024 Accuracy and Precision

Measurement	Target Accuracy	Target Precision	Q4 2024 Calibration Results[1]
Missile Site Park			
$NO_x/NO/NO_2$	±15%	±15.1%	PASS[2]
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 B of the Quarter 4 2024 report.

[2] The lowest two flow set points on the high-flow mass flow controller (MFC) were found to be outside of acceptance criteria during the Q4 2024 audit check and were subsequently re-calibrated to be within specification. It was determined that this result did not impact data since this flow rate is outside the range of flows that the MFC operates in during all calibration checks.

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. Q1 2025 wet deposition and gaseous ammonia data from NADP are not yet available. When Q1 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 Q1 2025.

5.1 Gaseous O_3 Data Summary

O_3 data collected for Q1 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. The daily maximum 8-hour ozone concentrations measured in Q1 2025 at all three stations remained below the level of both the 2008 and 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 6**. **Table 7** 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 and 2015 standards.

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.

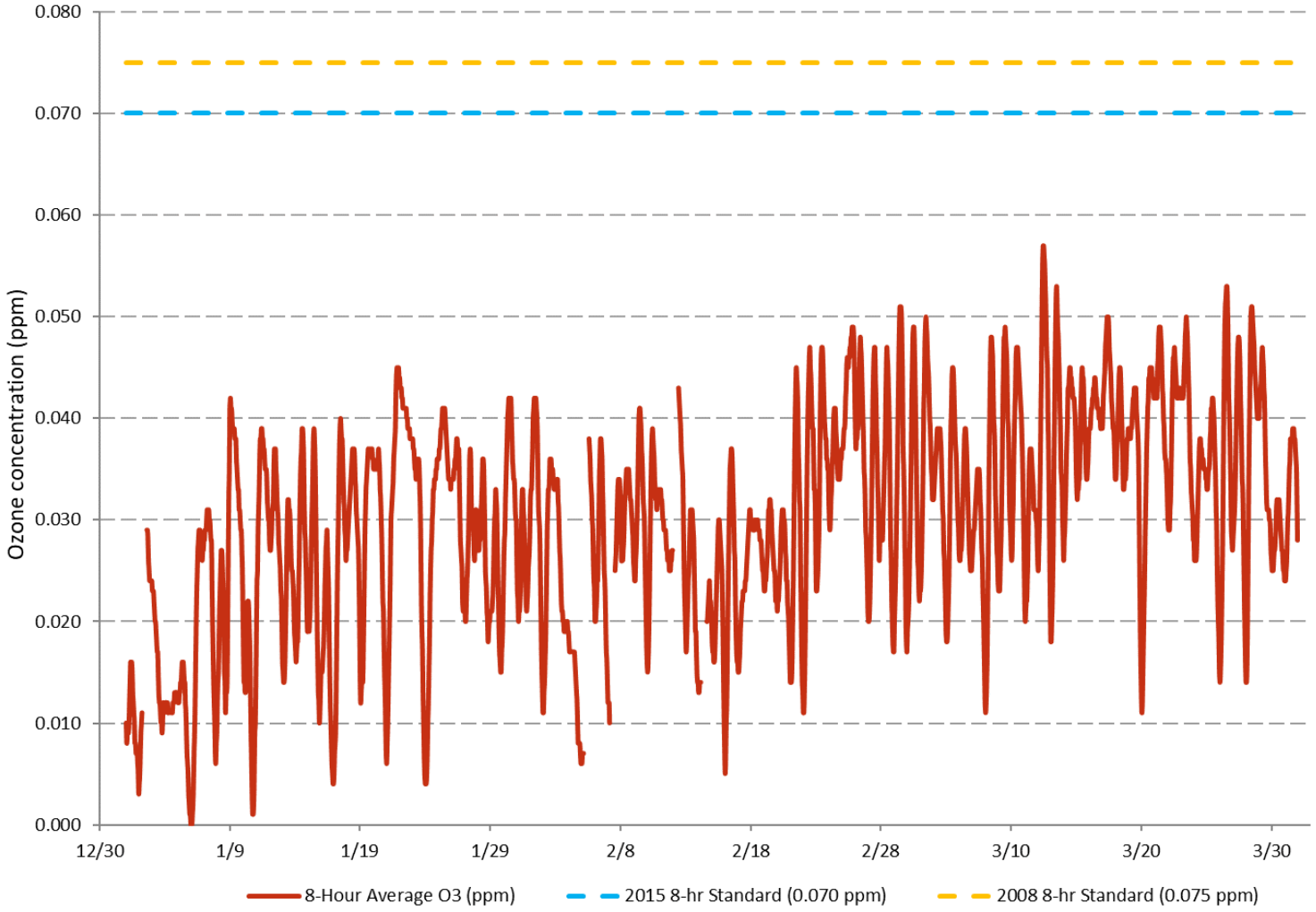

Figure 3. MSP Q1 2025 Rolling 8-hour averaged O_3

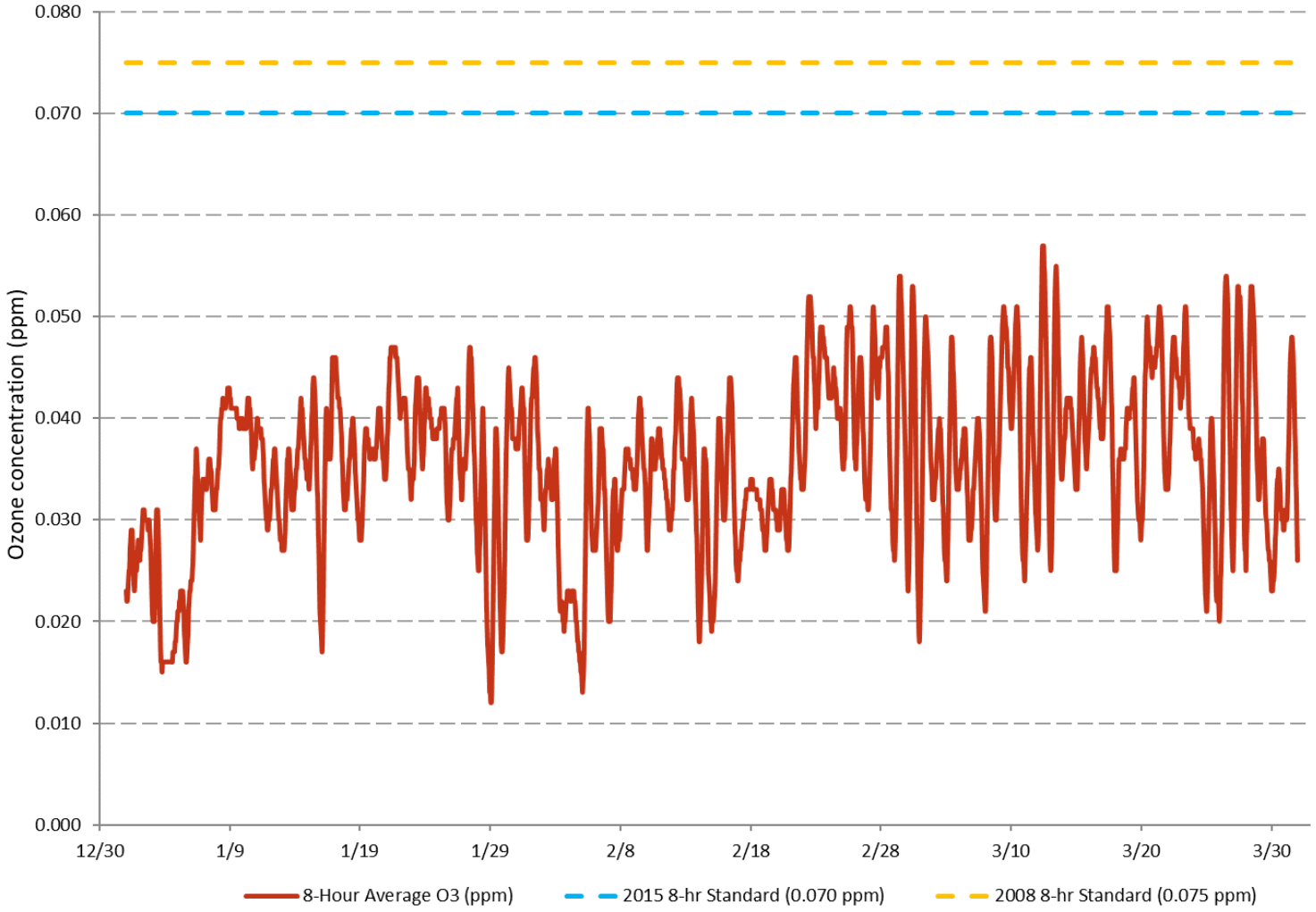

Figure 4. Hereford Q1 2025 Rolling 8-hour averaged O_3

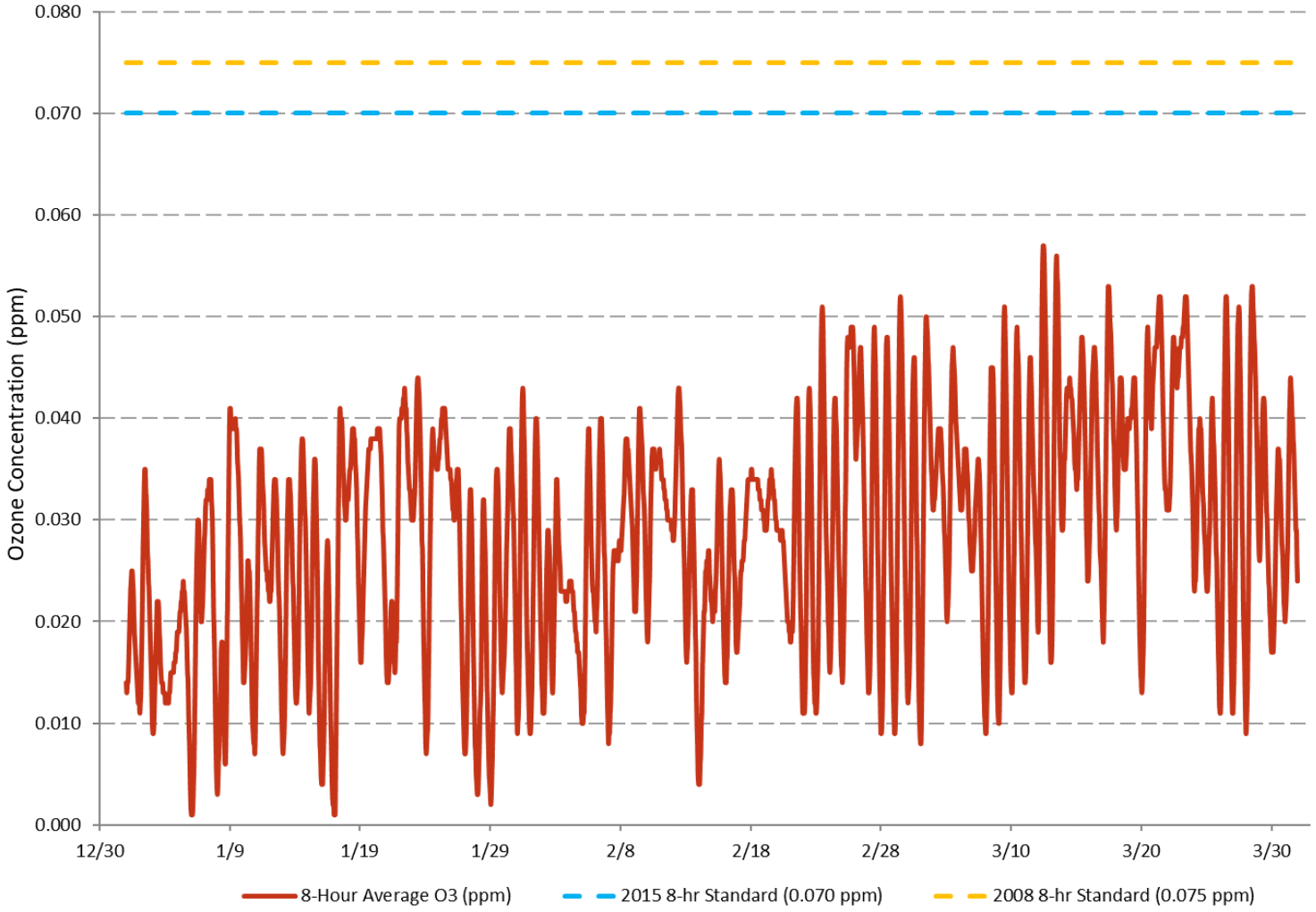

Figure 5. Orchard Q1 2025 Rolling 8-hour averaged O_3

Table 6. 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	0.057	3/12/2025	0.053	3/13/2025	0.053	3/26/2025	0.051	3/1/2025	0	0
Hereford	0.057	3/12/2025	0.055	3/13/2025	0.054	3/1/2025	0.054	3/26/2025	0	0
Orchard	0.057	3/12/2025	0.056	3/13/2025	0.053	3/17/2025	0.053	3/28/2025	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 7. 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]	0.051	0.066	No	0.054	0.064	No	0.053	0.063	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 Q1 2025 was 42.9 ppb, recorded on January 8th at 18:00 Mountain Standard Time. A timeseries of hourly NO_2 data collected in Q1 2025 is presented in **Figure 6**. Note, the gaps in the data from January 25th through February 7th and February 12th through February 14th are invalid since

those periods do not meet quality assurance requirements, see the annotation in **Figure 6**. A summary of NO_2 data collected year-to-date is presented in **Table 8** and **Table 9**.

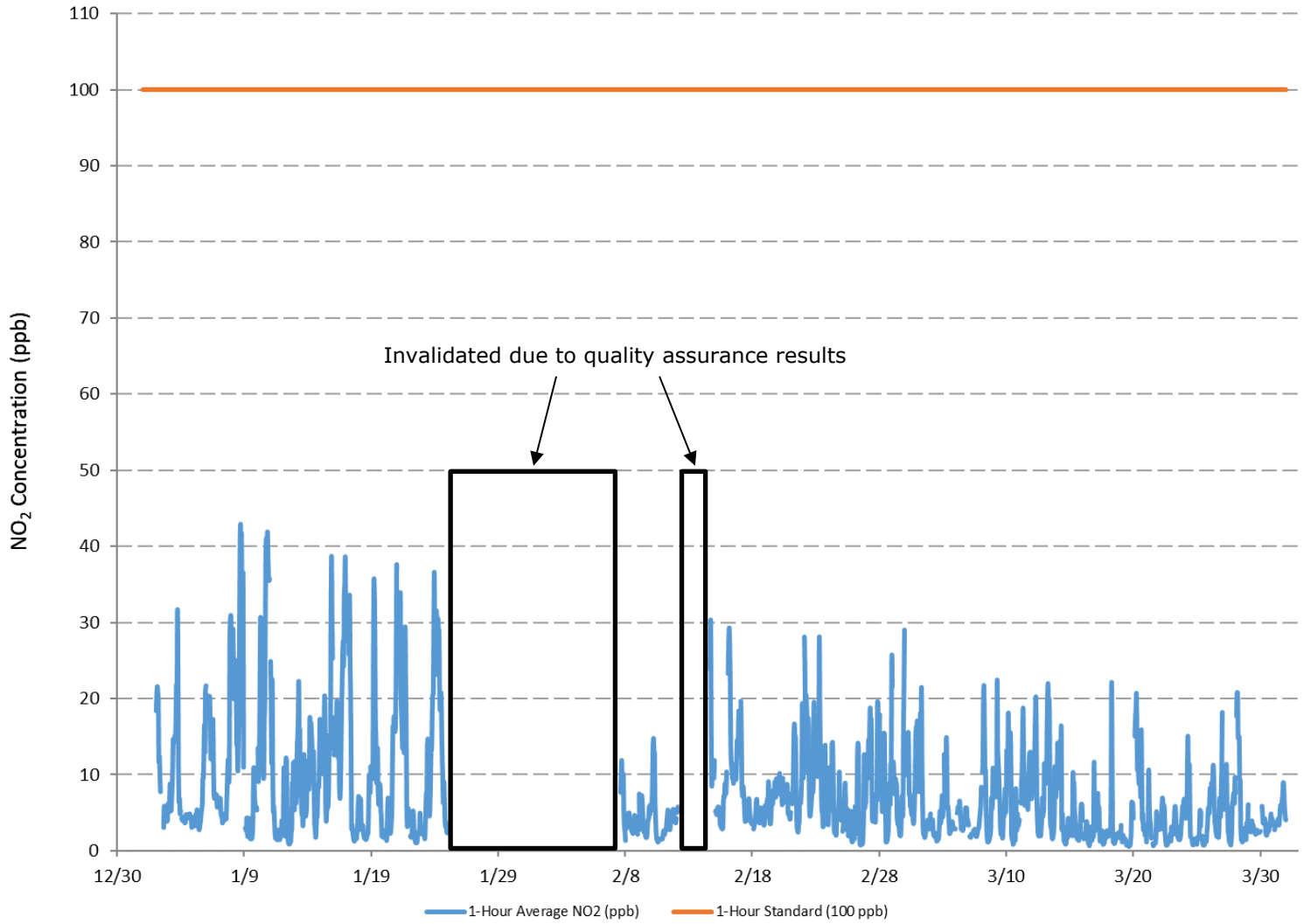

Figure 6. MSP Q1 2025 1-Hour Averaged NO_2

Table 8. 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 9. 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	-	-	-	-	-[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 Q1 2025.

6.1 Wind Data Summary

The Q1 2025 average wind speed at the three stations at 10-m above ground level (agl) was 3.5 meters per second (m/s), 5.1 m/s, and 3.7 m/s at MSP, Hereford, and Orchard, respectively. The maximum hourly average wind speed for Q1 2025 was 15.5 m/s at MSP, 17.8 m/s at Hereford, and 19.4 m/s at Orchard. **Figure 7** through **Figure 9** present wind rose plots for each station during Q1 2025. These wind roses are a graphical representation of how the wind speed and direction were distributed for Q1 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 Q1 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 southwesterly and northwesterly winds. The strongest winds came from the northwest or southwesterly quadrants. At the Hereford station winds mostly came from the northwest and were also the fastest from the northwest and north. At the Orchard station winds mostly came from the east and west but were the strongest from the north. Monthly average hourly and maximum wind speeds per month at each station are listed in **Table 10** along with all other measured meteorological parameters.

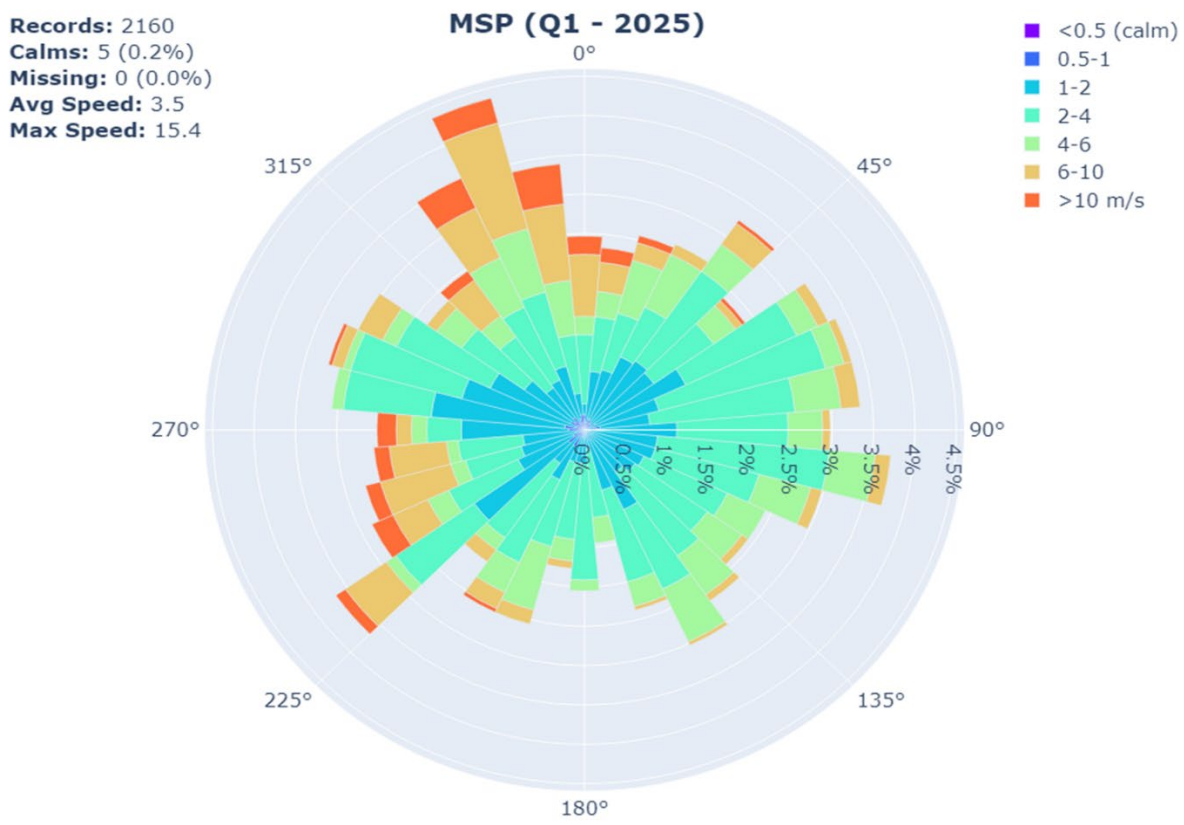

Figure 7. MSP Q1 2025 Wind Rose

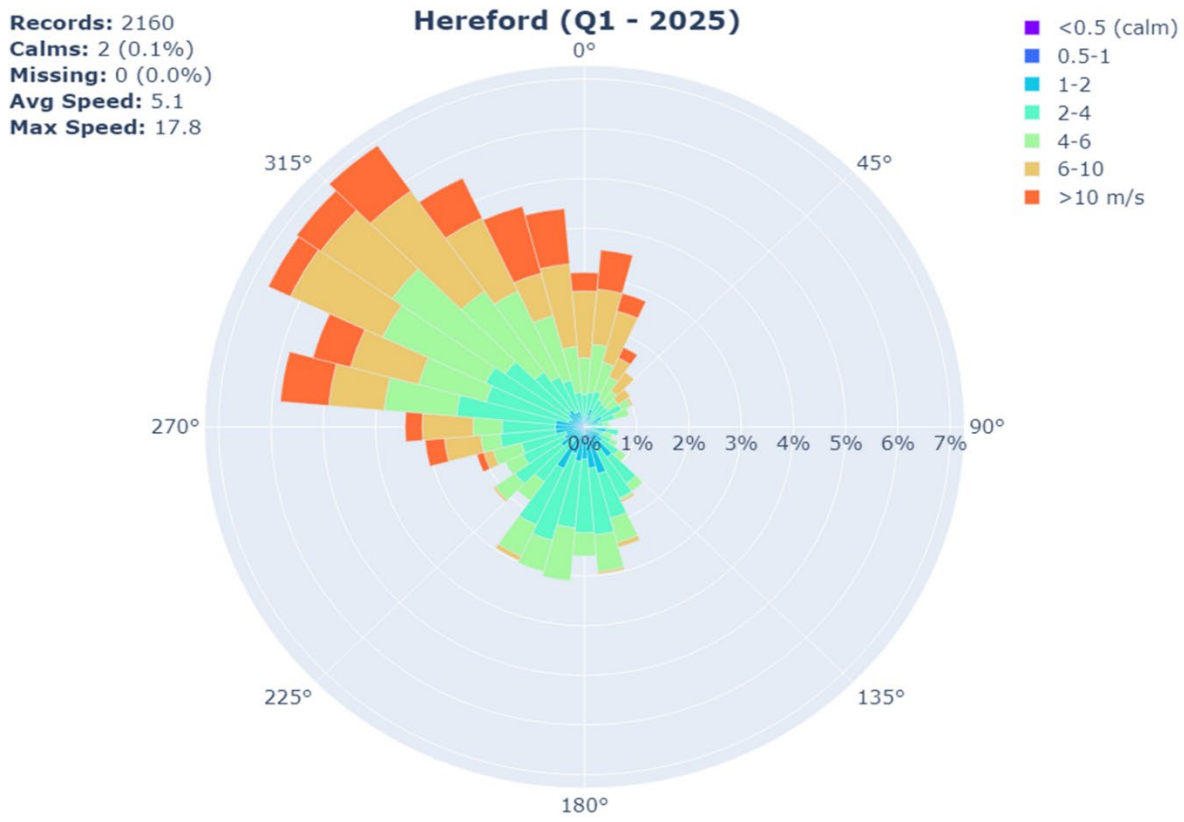

Figure 8. Hereford Q1 2025 Wind Rose

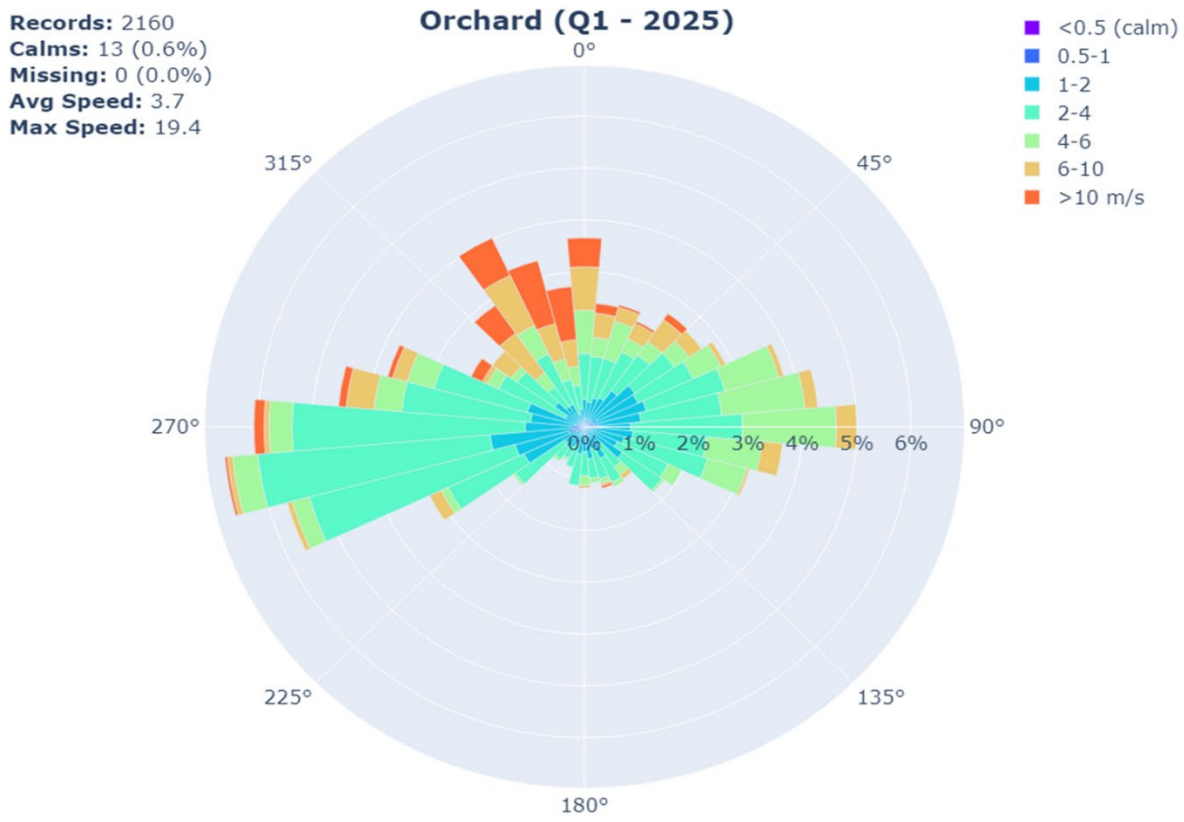

Figure 9. Orchard Q1 2025 Wind Rose

Table 10. Q1 2025 Meteorological Data Summary

Parameter	Units	Form	January	February	March
Missile Site Park					
2-M Temperature	°C	Monthly Average	-4.5	-1.3	8.1
		Maximum Hourly Average	12.3	19.0	25.8
		Minimum Hourly Average	-24.8	-20.6	-7.1
10-M Temperature	°C	Monthly Average	-4.1	-1.1	8.2
		Maximum Hourly Average	12.1	18.6	24.9
		Minimum Hourly Average	-24.5	-20.1	-6.4
Delta Temperature	°C	Monthly Average	0.4	0.2	0.1
		Maximum Hourly Average	3.3	3.3	3.4
		Minimum Hourly Average	-0.8	-1.4	-1.7
10-M Horizontal Wind Speed	m/s	Monthly Average	2.9	3.4	4.2
		Maximum Hourly Average	11.4	15.1	15.5
2-M Relative Humidity	Percent	Monthly Average	67.1	63.3	43.4
		Maximum Hourly Average	98.3	99.8	100.0
Station Barometric Pressure	mm Hg	Monthly Average	637.5	635.1	631.9
		Maximum Hourly Average	645.7	643.5	641.1
Station Precipitation	in	Monthly Total	0.192	0.160	1.185
	in/hr	Maximum Hourly Total	0.012	0.028	0.146
2-M Solar Radiation	W/m^2	Monthly Average	105	151	194
		Maximum Hourly Average	640	767	924
Hereford					
2-M Temperature	°C	Monthly Average	-5.5	-3.1	5.5
		Maximum Hourly Average	12.3	17.9	24.5
		Minimum Hourly Average	-25.7	-22.7	-11.2

Parameter	Units	Form	January	February	March
10-M Temperature	°C	Monthly Average	-5.1	-2.9	6.1
		Maximum Hourly Average	11.9	17.2	23.6
		Minimum Hourly Average	-24.9	-21.5	-8.3
Delta Temperature	°C	Monthly Average	0.5	0.2	0.5
		Maximum Hourly Average	6.4	6.5	9.0
		Minimum Hourly Average	-1.3	-1.6	-1.7
10-M Horizontal Wind Speed	m/s	Monthly Average	5.0	4.5	5.6
		Maximum Hourly Average	16.2	16.2	17.8
2-M Relative Humidity	Percent	Monthly Average	69.3	65.3	51.5
		Maximum Hourly Average	98.9	97.7	100.0
Station Barometric Pressure	mm Hg	Monthly Average	628.8	626.6	623.8
		Maximum Hourly Average	636.5	633.9	633.1
Station Precipitation	in	Monthly Total	0.198	0.100	0.652
	in/hr	Maximum Hourly Total	0.047	0.024	0.118
2-M Solar Radiation	W/m^2	Monthly Average	102	145	191
		Maximum Hourly Average	606	749	875
Orchard					
2-M Temperature	°C	Monthly Average	-6.1	-3.1	6.5
		Maximum Hourly Average	13.7	21.4	26.7
		Minimum Hourly Average	-27.9	-25.7	-12.4
10-M Temperature	°C	Monthly Average	-5.3	-2.5	7.2
		Maximum Hourly Average	12.7	20.7	25.6
		Minimum Hourly Average	-25.6	-23.6	-8.4
Delta Temperature	°C	Monthly Average	0.7	0.6	0.7
		Maximum Hourly Average	6.3	6.1	7.4
		Minimum Hourly Average	-1.2	-1.5	-1.8

Parameter	Units	Form	January	February	March
10-M Horizontal Wind Speed	m/s	Monthly Average	3.3	3.5	4.3
		Maximum Hourly Average	17.2	15.1	19.4
2-M Relative Humidity	Percent	Monthly Average	73.9	68.4	52.9
		Maximum Hourly Average	98.0	98.9	99.7
Station Barometric Pressure	mm Hg	Monthly Average	650.0	647.6	643.7
		Maximum Hourly Average	658.4	657.0	654.2
Station Precipitation	in	Monthly Total	0.204	0.135	1.038
	in/hr	Maximum Hourly Total	0.024	0.055	0.095
2-M Solar Radiation	W/m^2	Monthly Average	106	149	195
		Maximum Hourly Average	642	760	884
[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. March had the highest total monthly precipitation at all three stations. A summary of total monthly and maximum hourly precipitation for Q1 2025 at all three stations is presented in **Figure 10** through **Figure 12** and in **Table 10**.

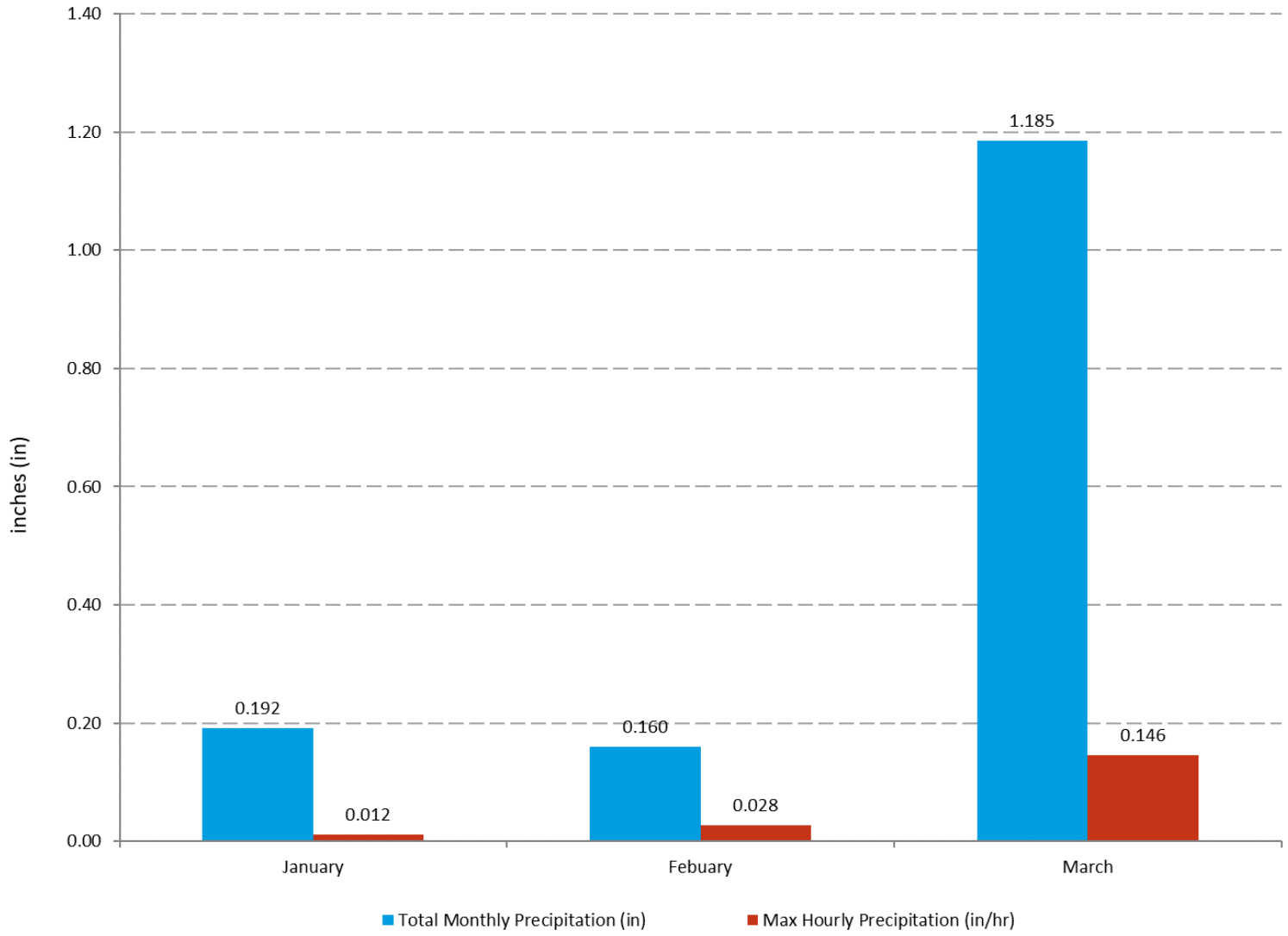

Figure 10. MSP Q1 2025 Precipitation Summary

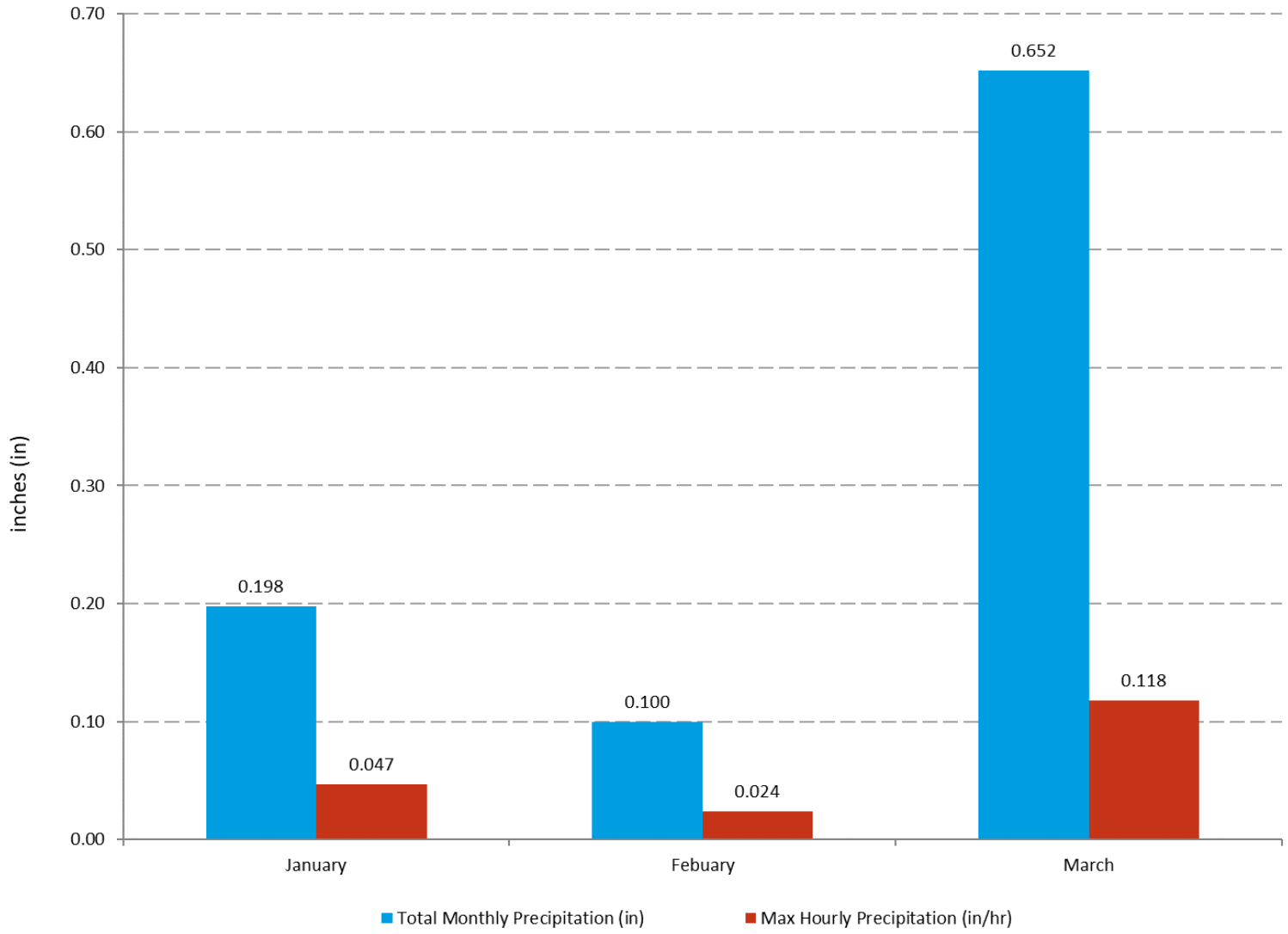

Figure 11. Hereford Q1 2025 Precipitation Summary

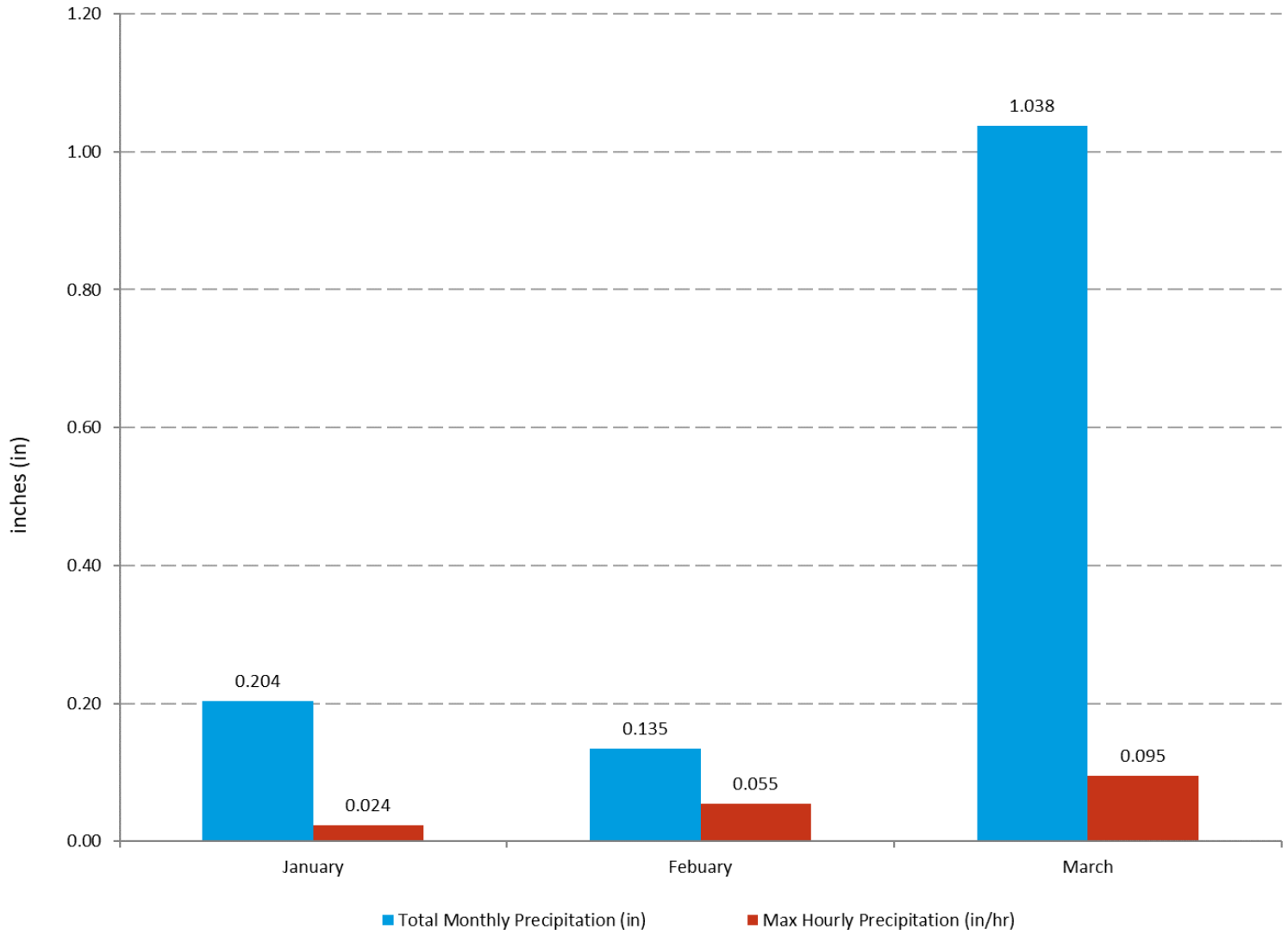

Figure 12. Orchard Q1 2025 Precipitation Summary

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 March for 2-m and 10-m agl at all three stations. The lowest temperatures occurred in January 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 Q1 2025 at all three stations is presented in **Figure 13** through **Figure 18** and **Table 10**.

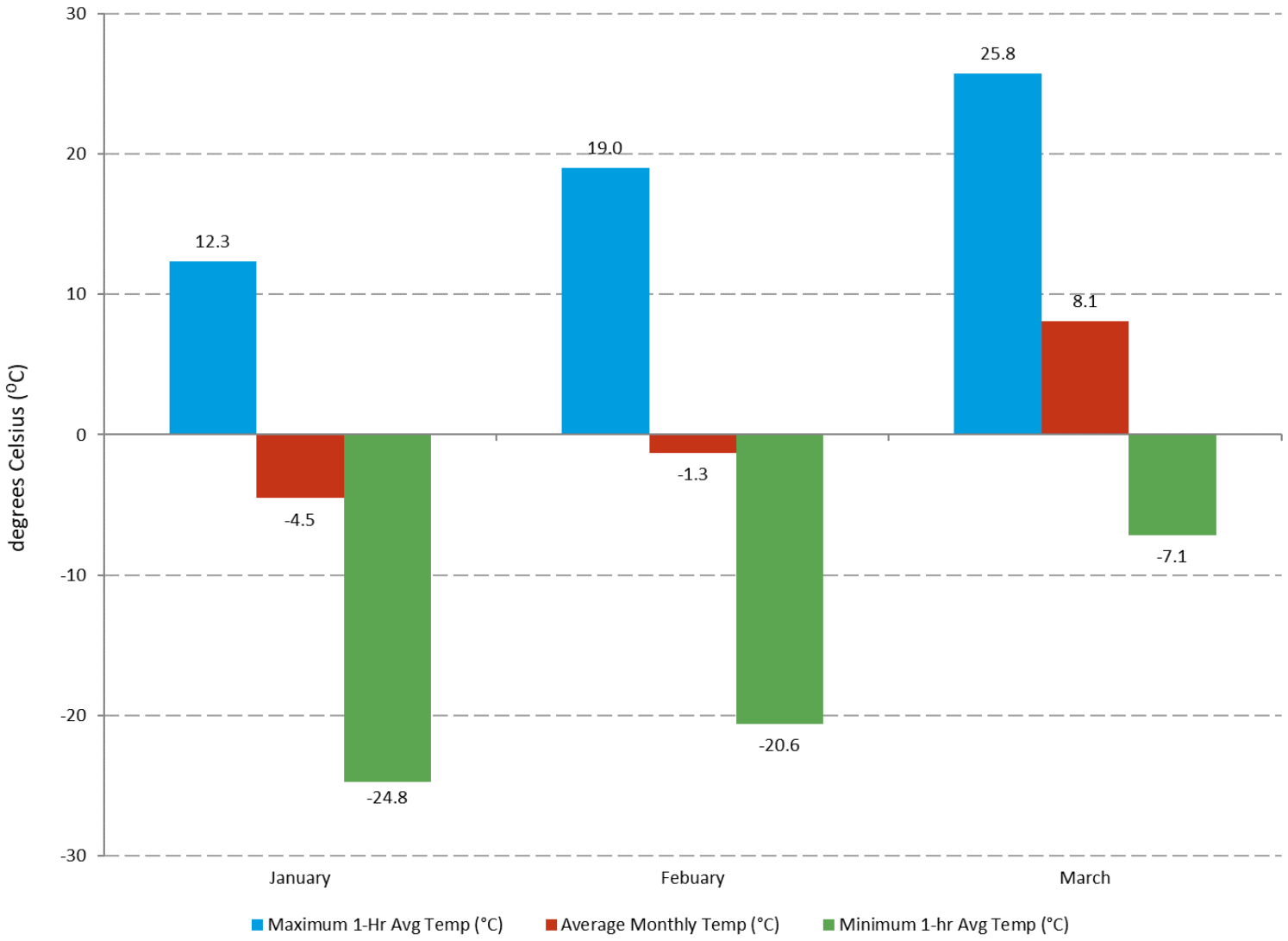

Figure 13. MSP Q1 2025 2-Meter Temperature Summary

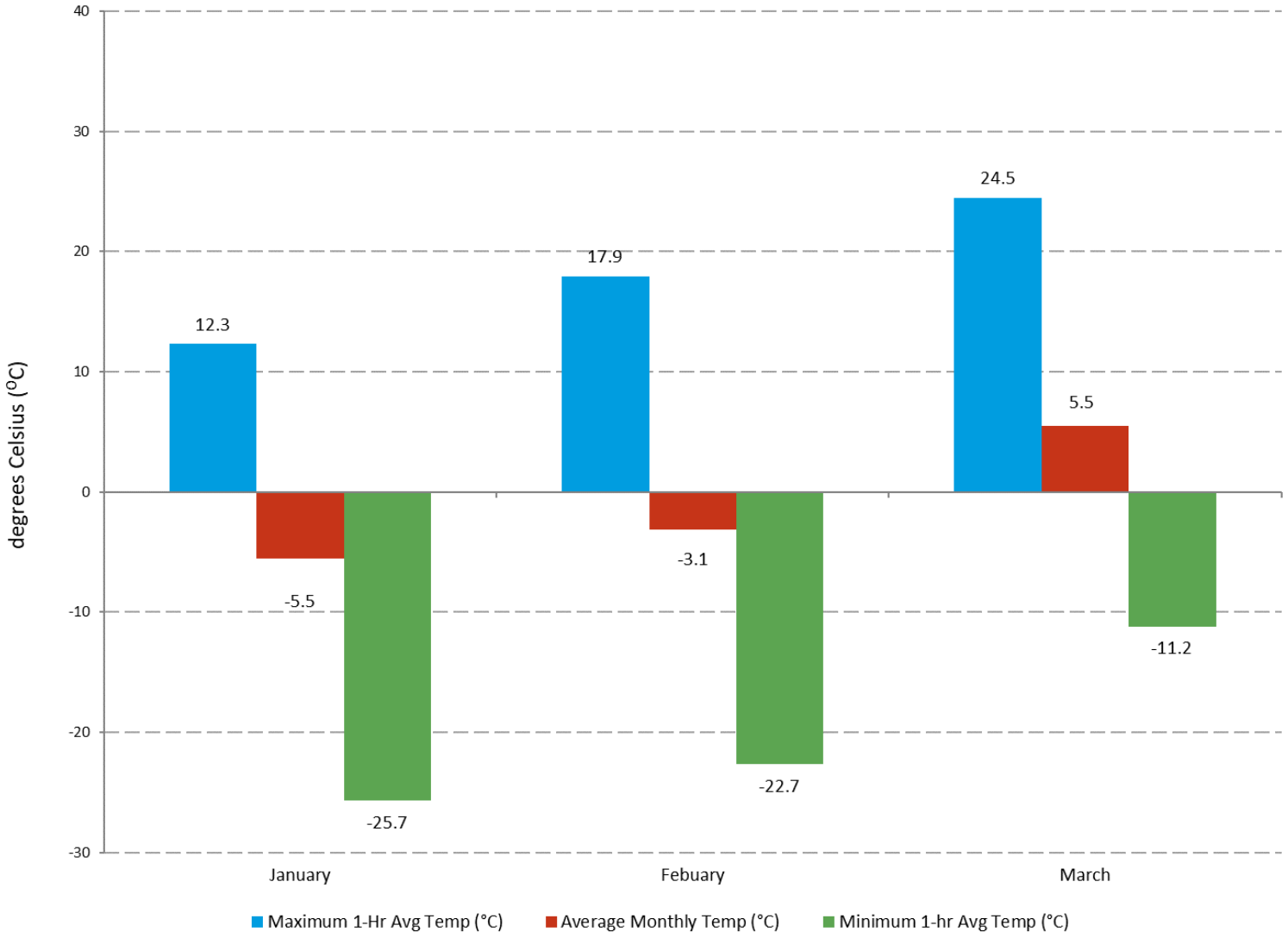

Figure 14. Hereford Q1 2025 2-Meter Temperature Summary

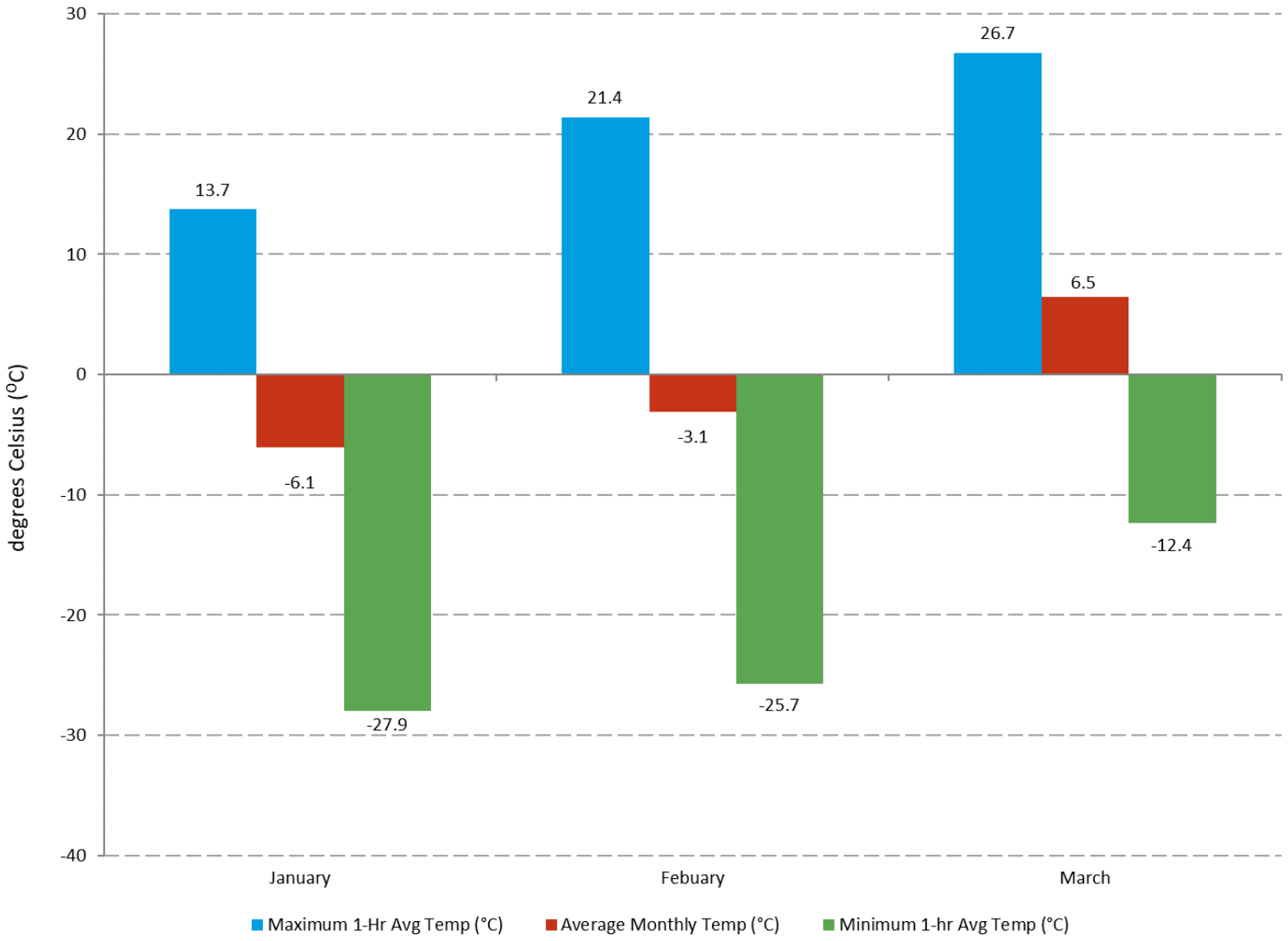

Figure 15. Orchard Q1 2025 2-Meter Temperature Summary

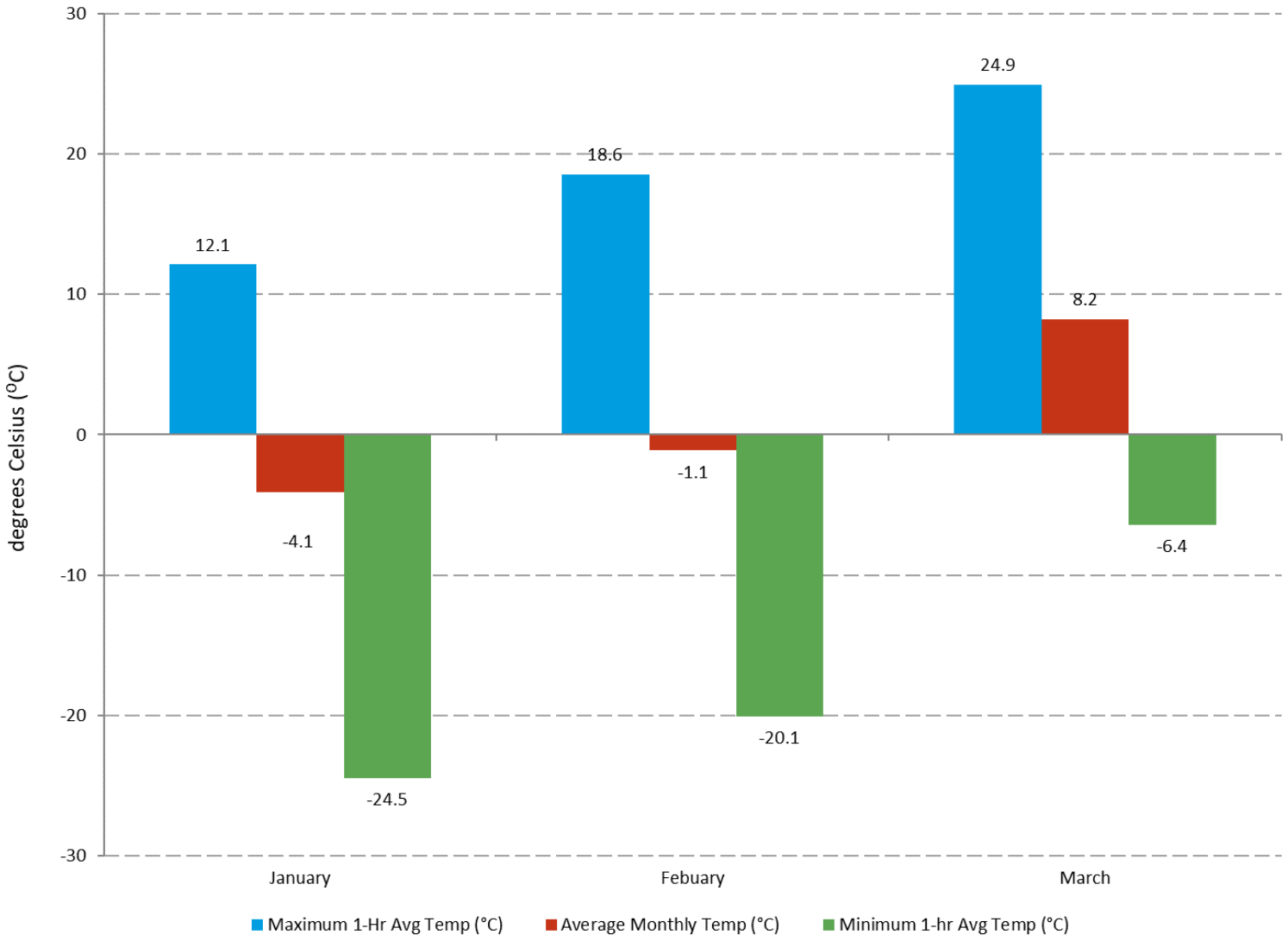

Figure 16. MSP Q1 2025 10-Meter Temperature Summary

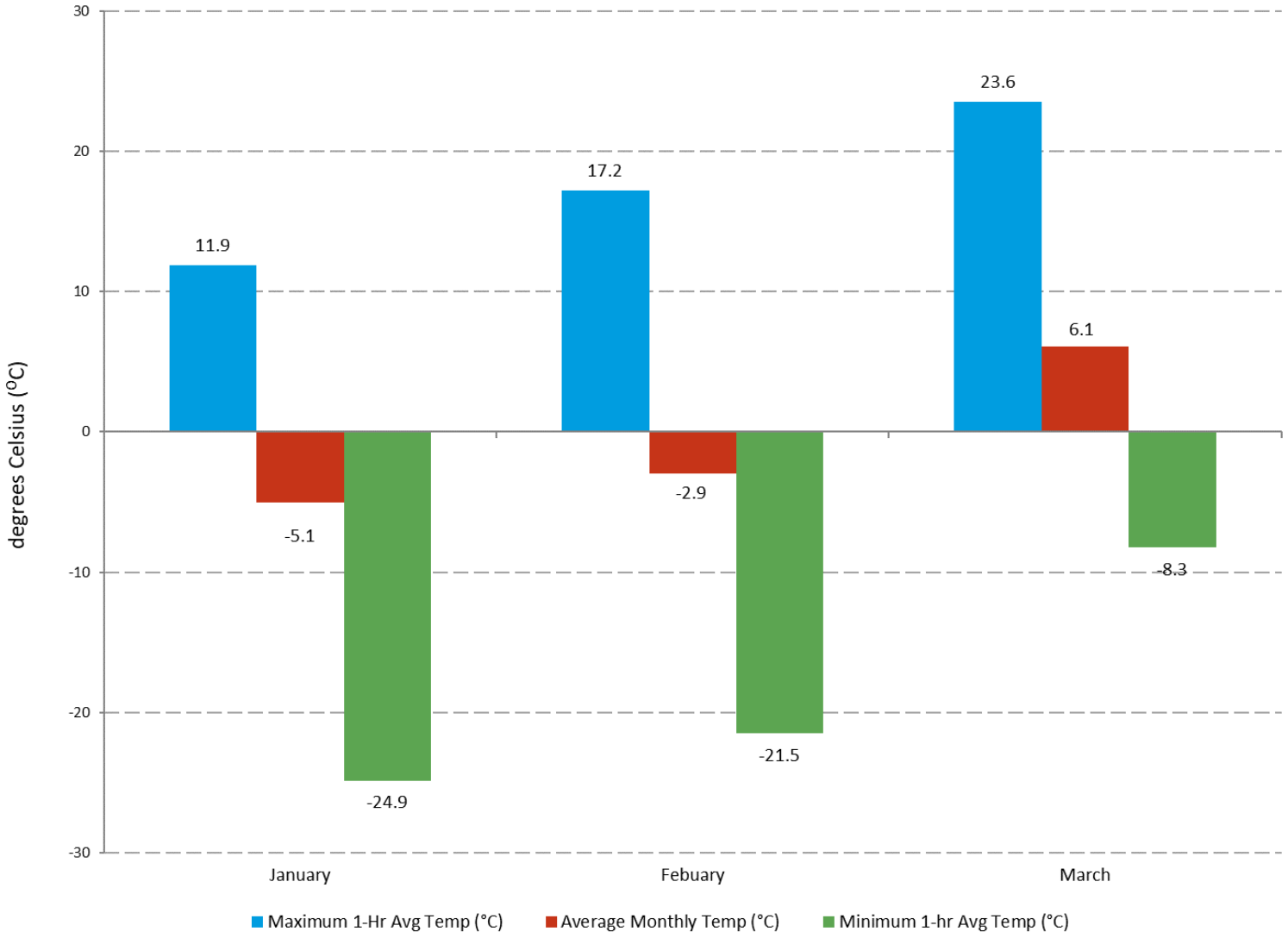

Figure 17. Hereford Q1 2025 10-Meter Temperature Summary

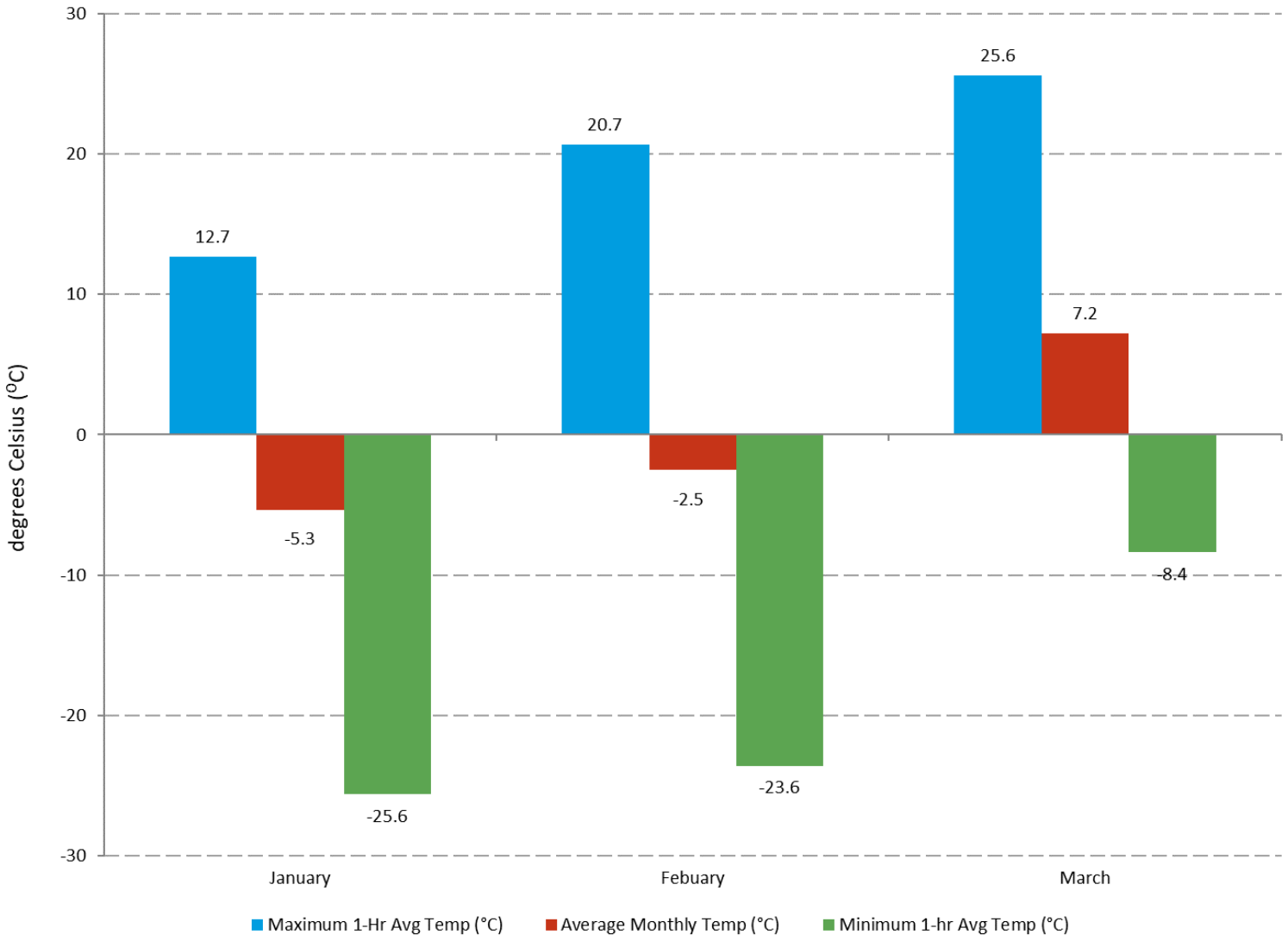

Figure 18. Orchard Q1 2025 10-Meter Temperature Summary

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 Q1 2025 at all three stations is presented in **Figure 19** through **Figure 21** and **Table 10**.

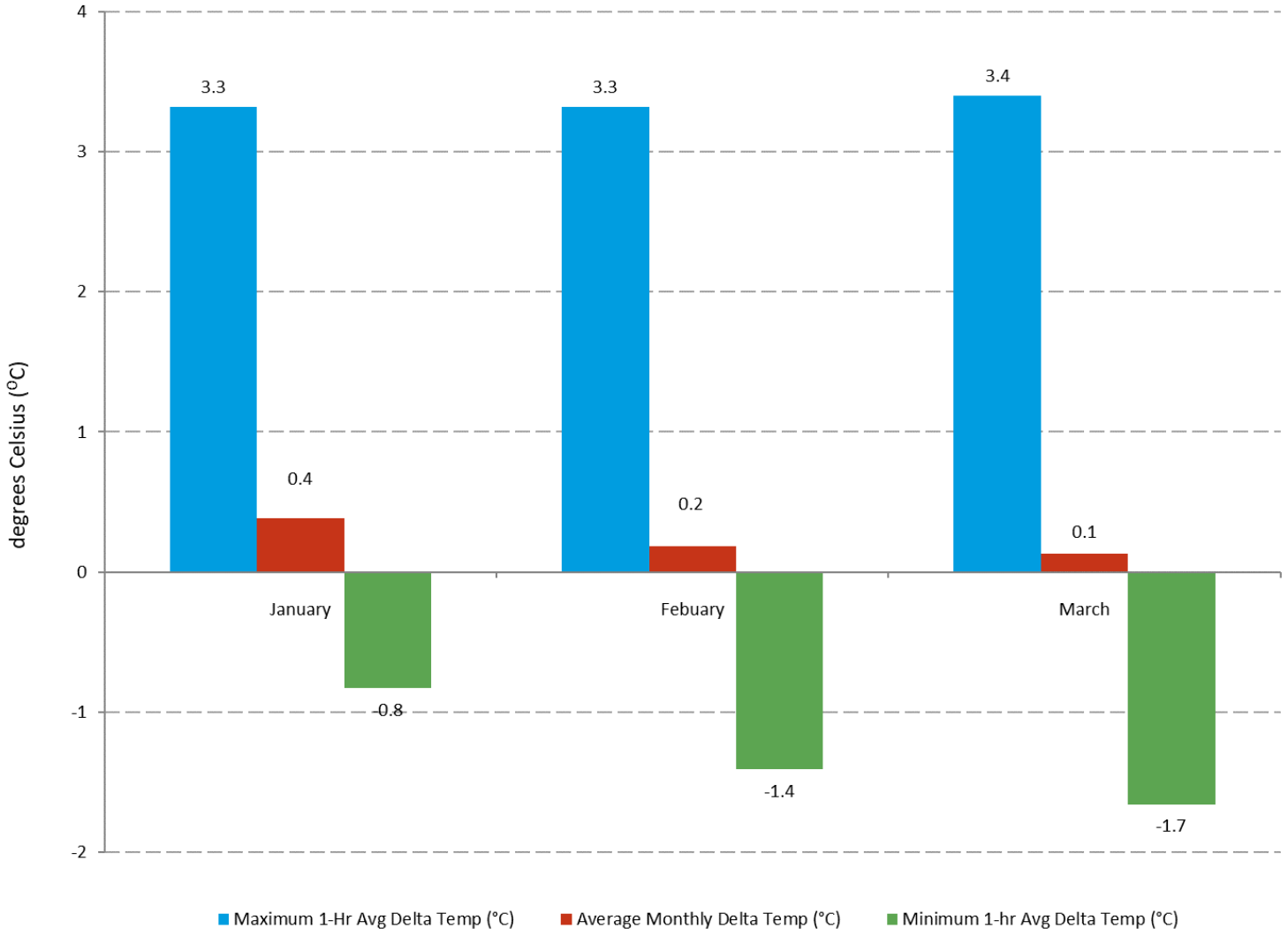

Figure 19. MSP Q1 2025 Delta Temperature Summary

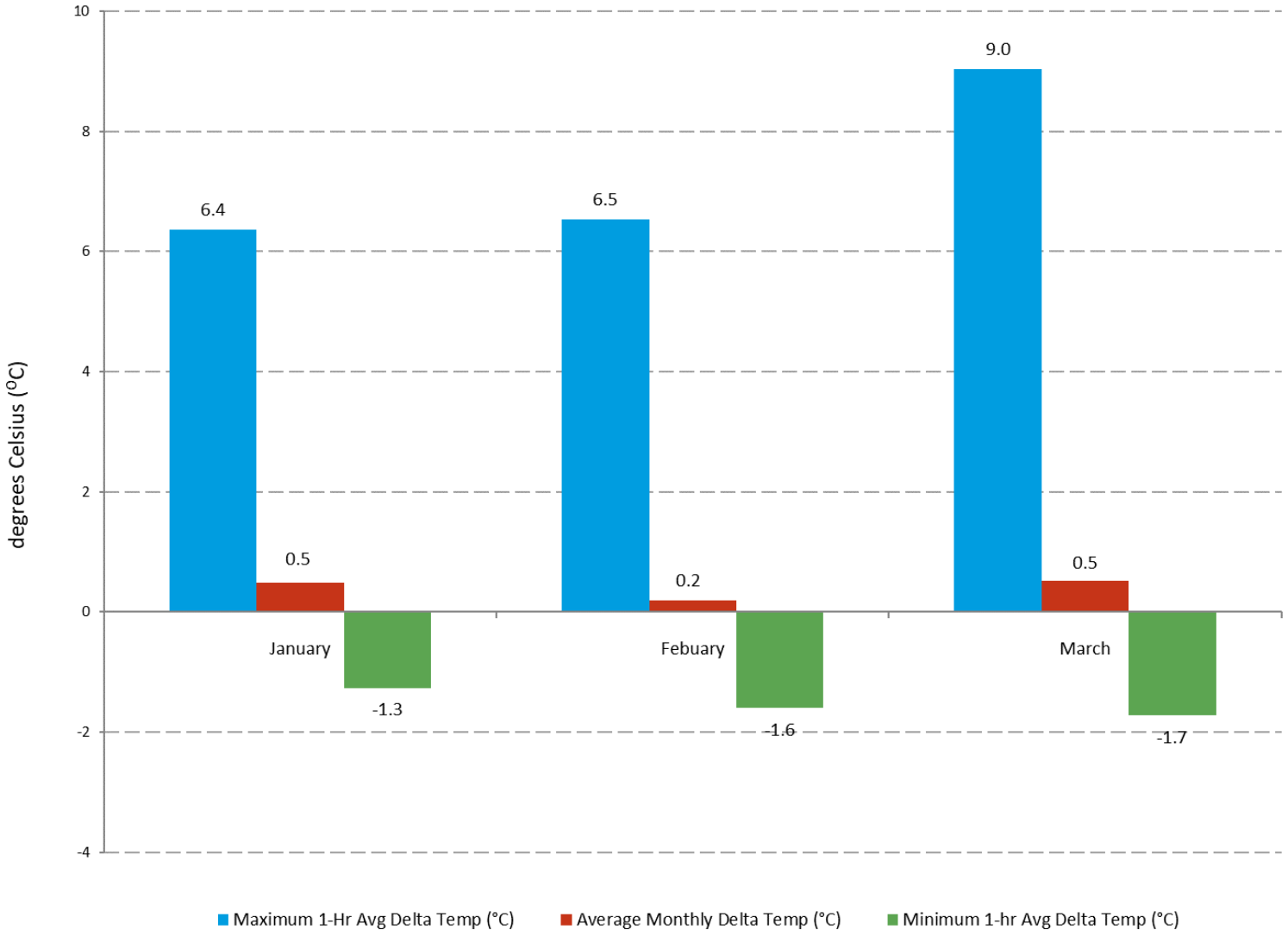

Figure 20. Hereford Q1 2025 Delta Temperature Summary

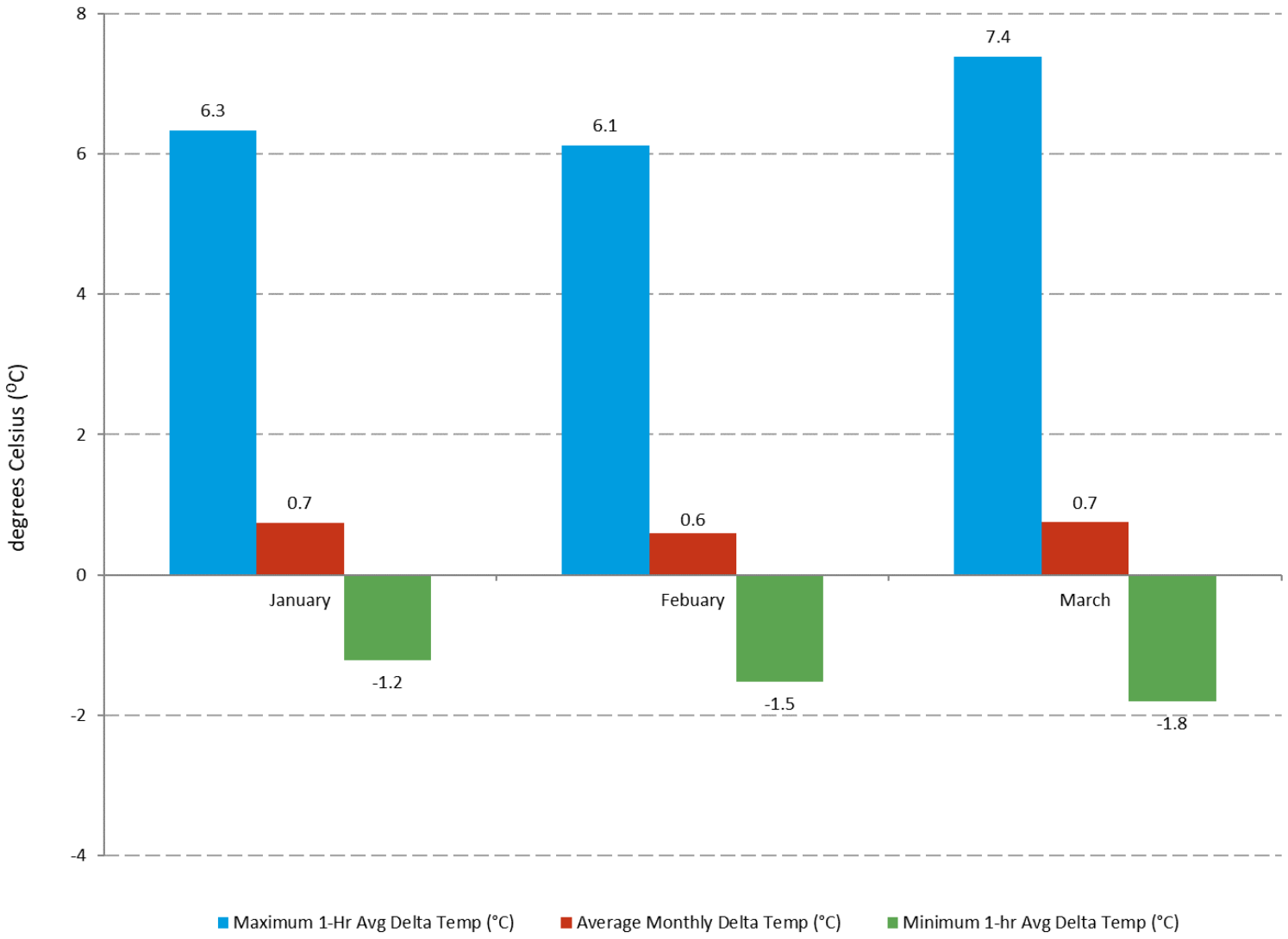

Figure 21. Orchard Q1 2025 Delta Temperature Summary

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 Q1 2025 at all three stations are summarized in **Figure 22** through **Figure 24** and **Table 10**.

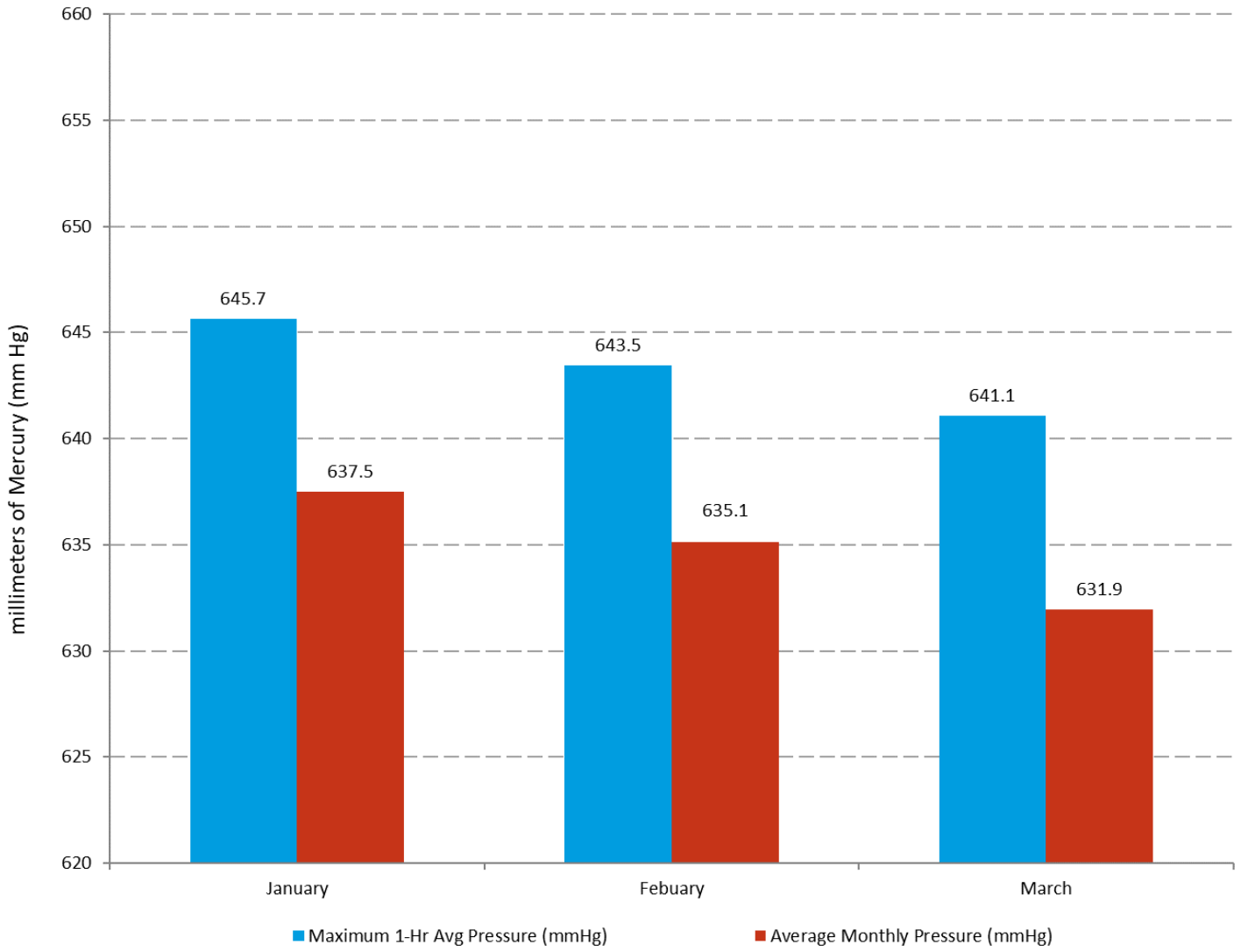

Figure 22. MSP Q1 2025 Barometric Pressure Summary

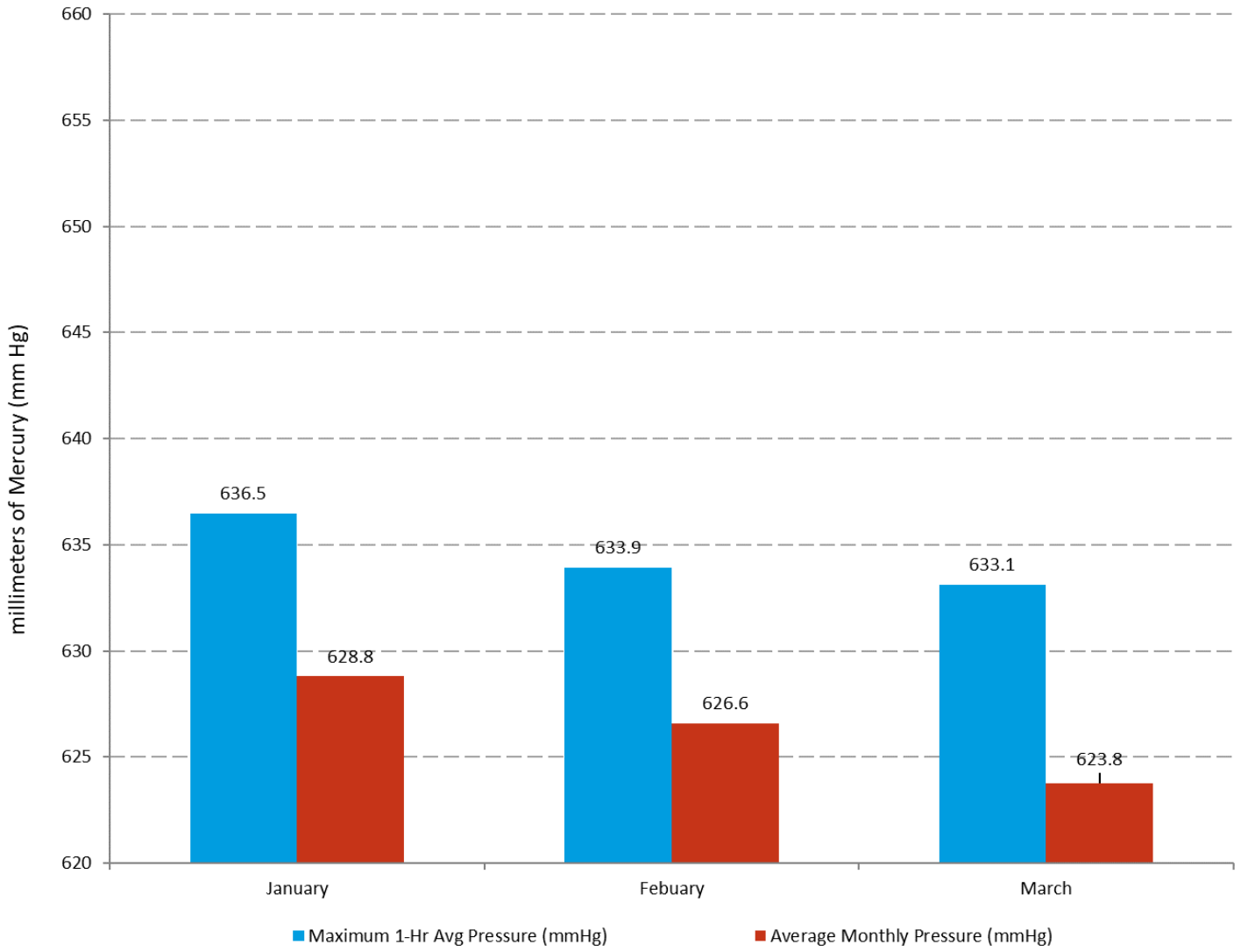

Figure 23. Hereford Q1 2025 Barometric Pressure Summary

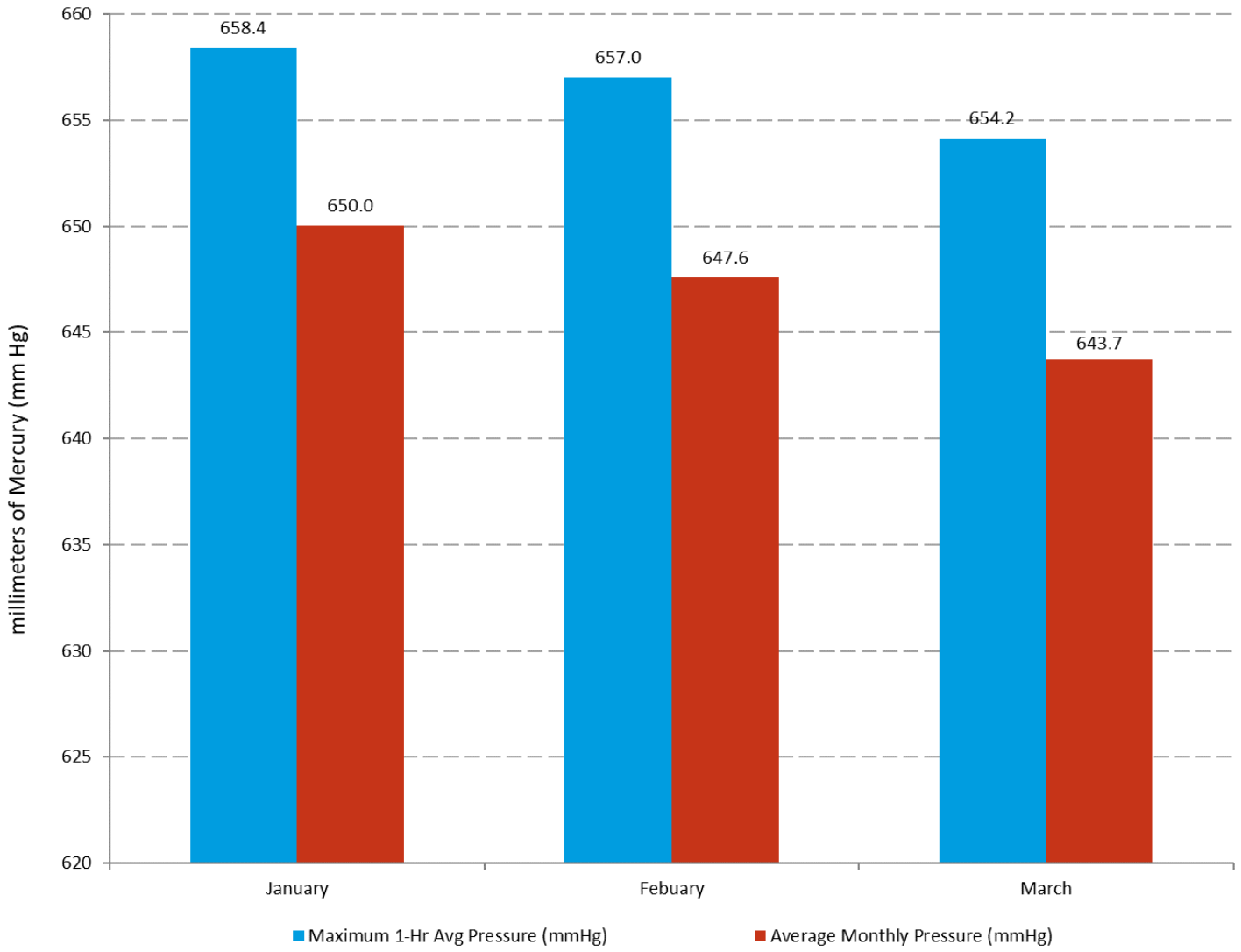

Figure 24. Orchard Q1 2025 Barometric Pressure Summary

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 43.4% and 73.9%. Maximum hourly average and monthly average relative humidity for Q1 2025 at all three stations is summarized in **Figure 25** through **Figure 27** and **Table 10**.

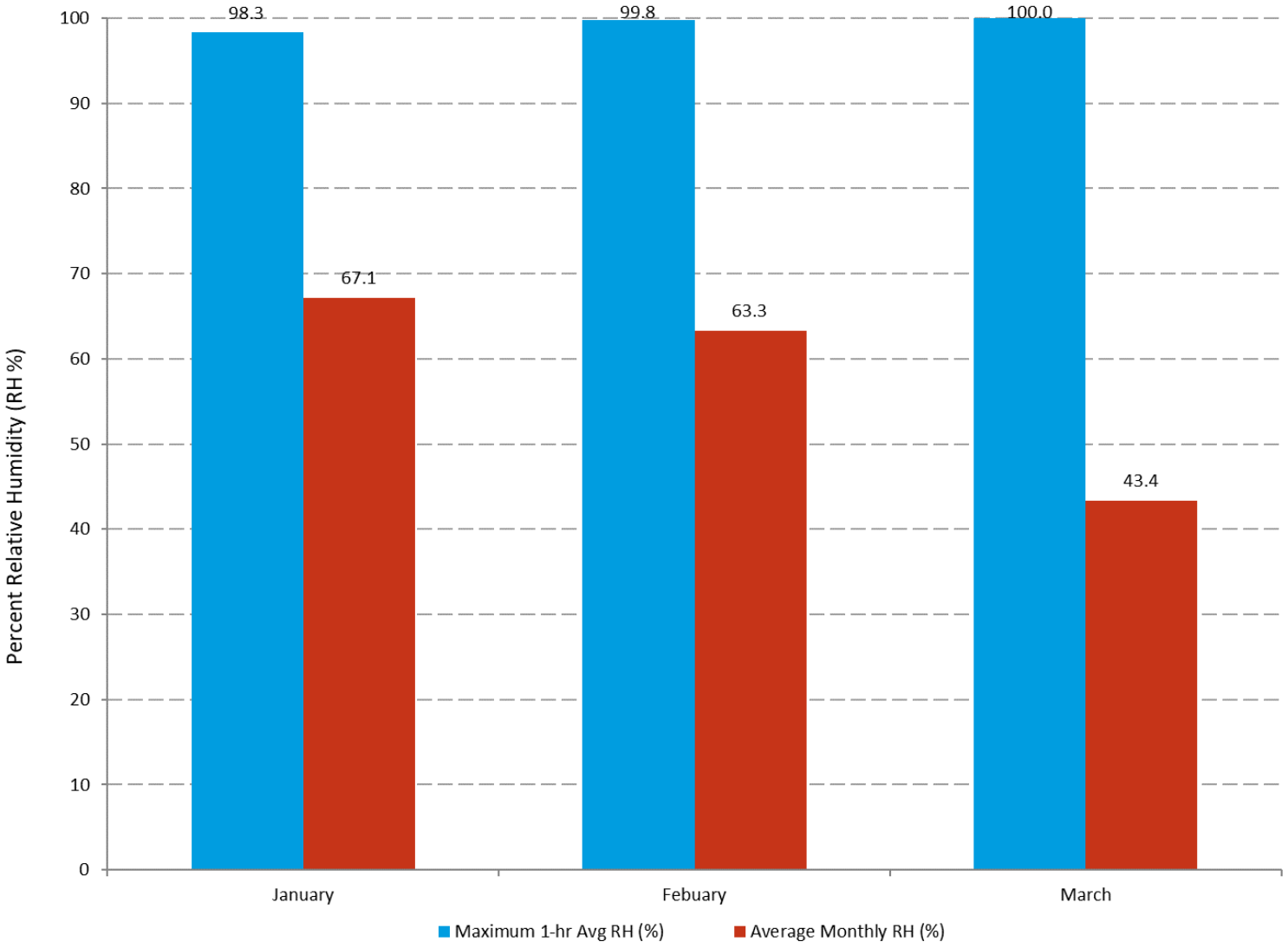

Figure 25. MSP Q1 2025 Relative Humidity Summary

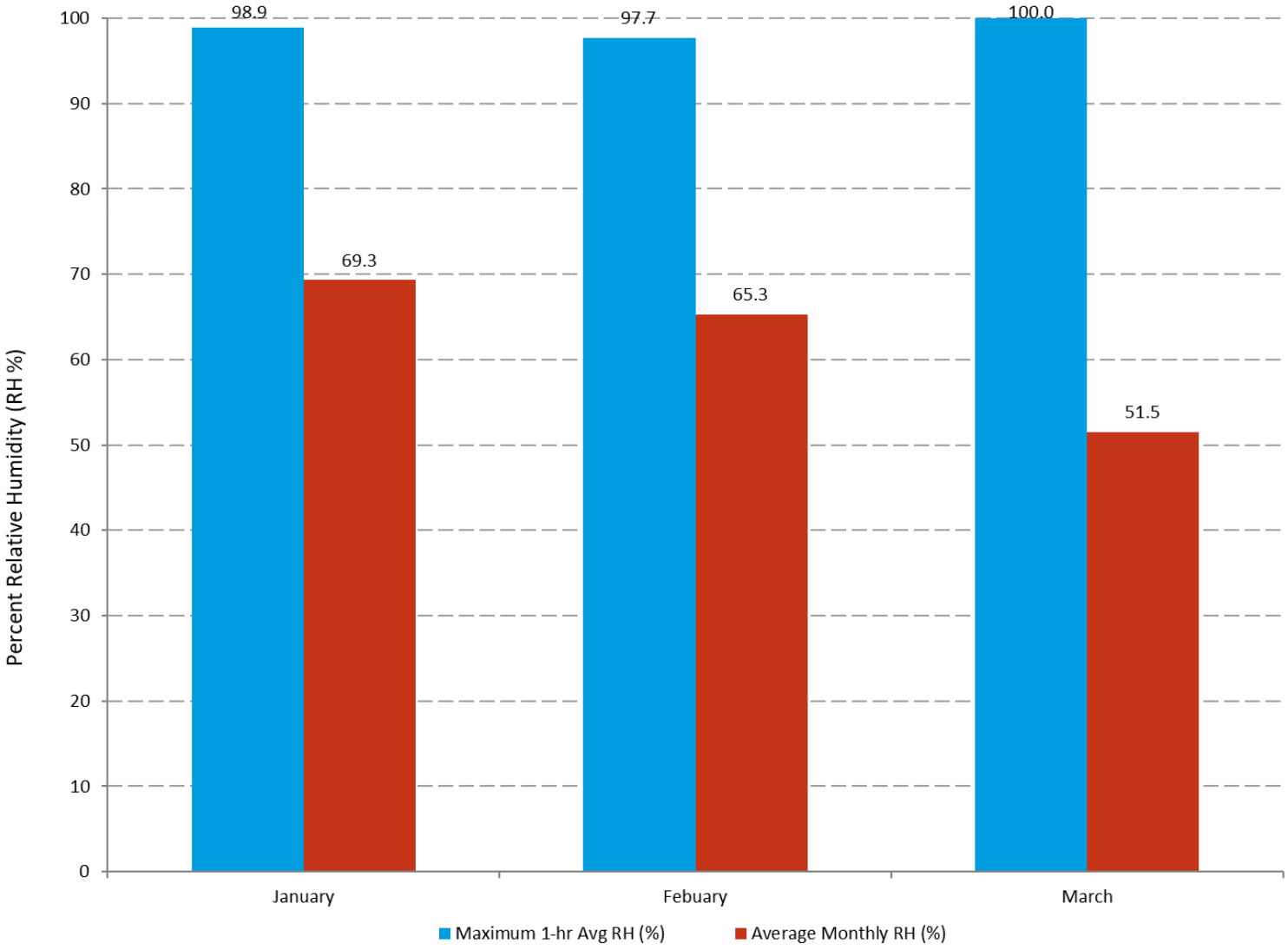

Figure 26. Hereford Q1 2025 Relative Humidity Summary

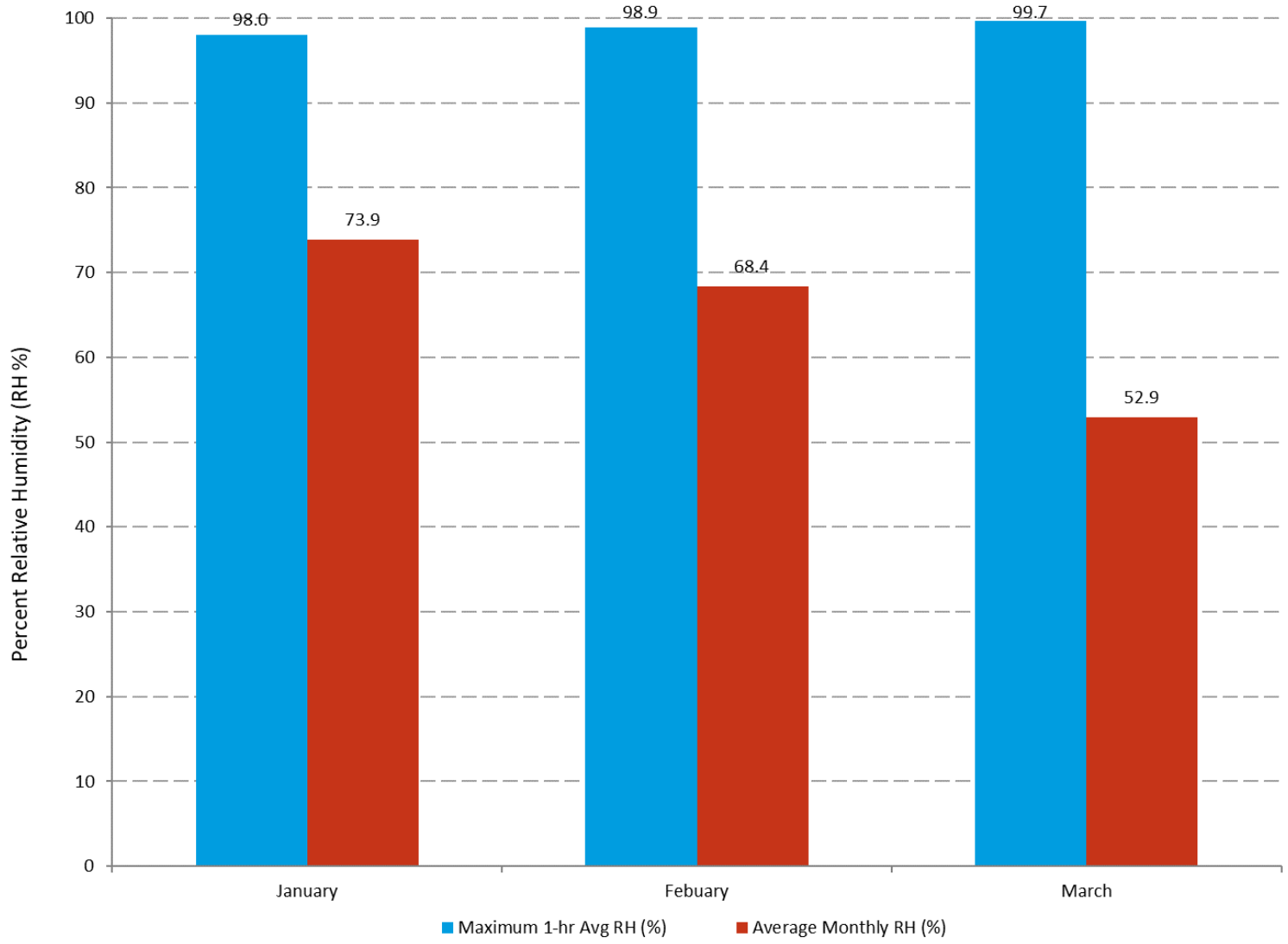

Figure 27. Orchard Q1 2025 Relative Humidity Summary

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 increased from January to March at all three stations, with 1-hour maximum solar radiation peaking in March. Maximum hourly average and monthly average solar radiation for Q1 2025 at all three stations is summarized in **Figure 28** through **Figure 30** and **Table 10**.

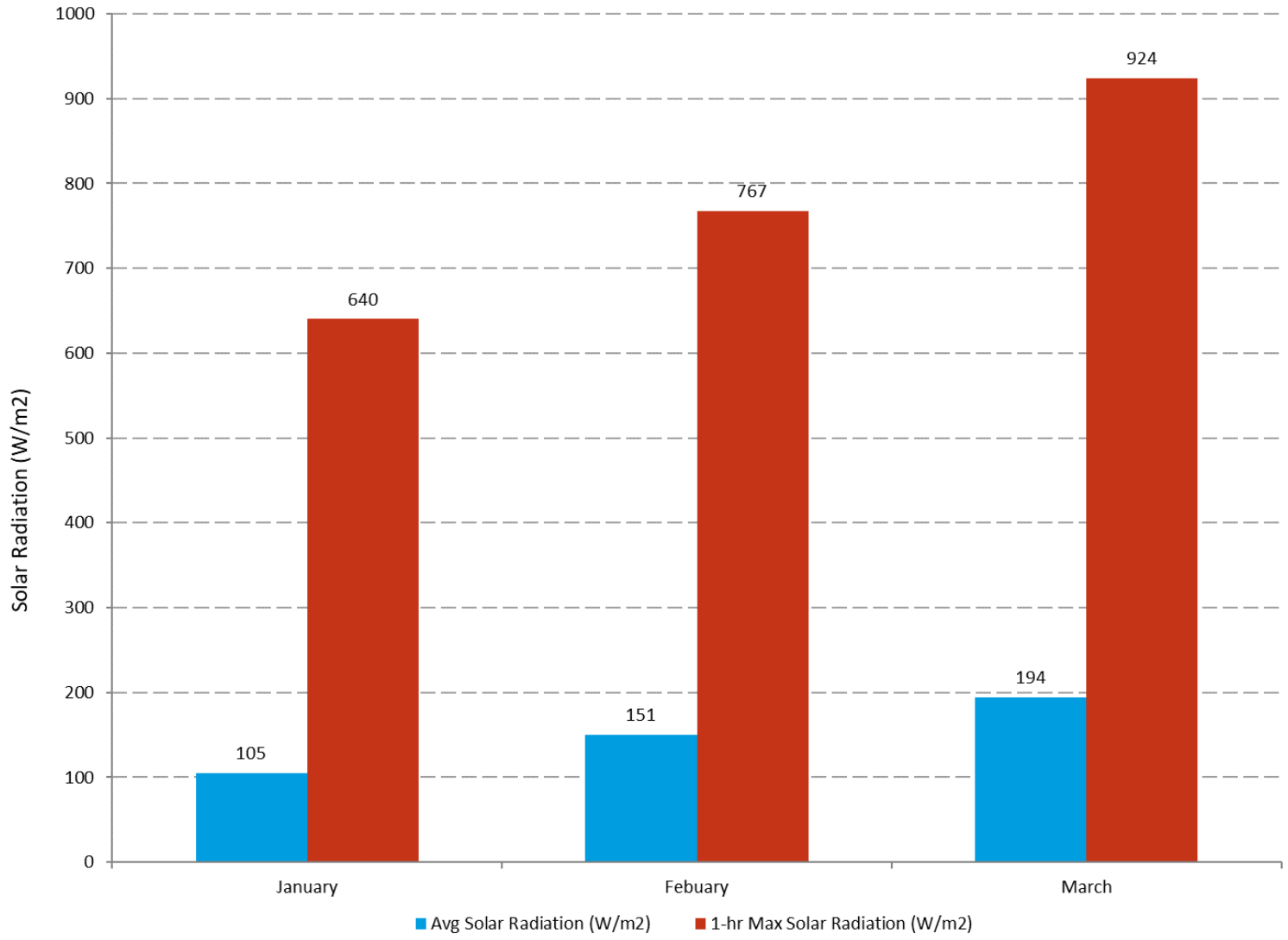

Figure 28. MSP Q1 2025 Solar Radiation Summary

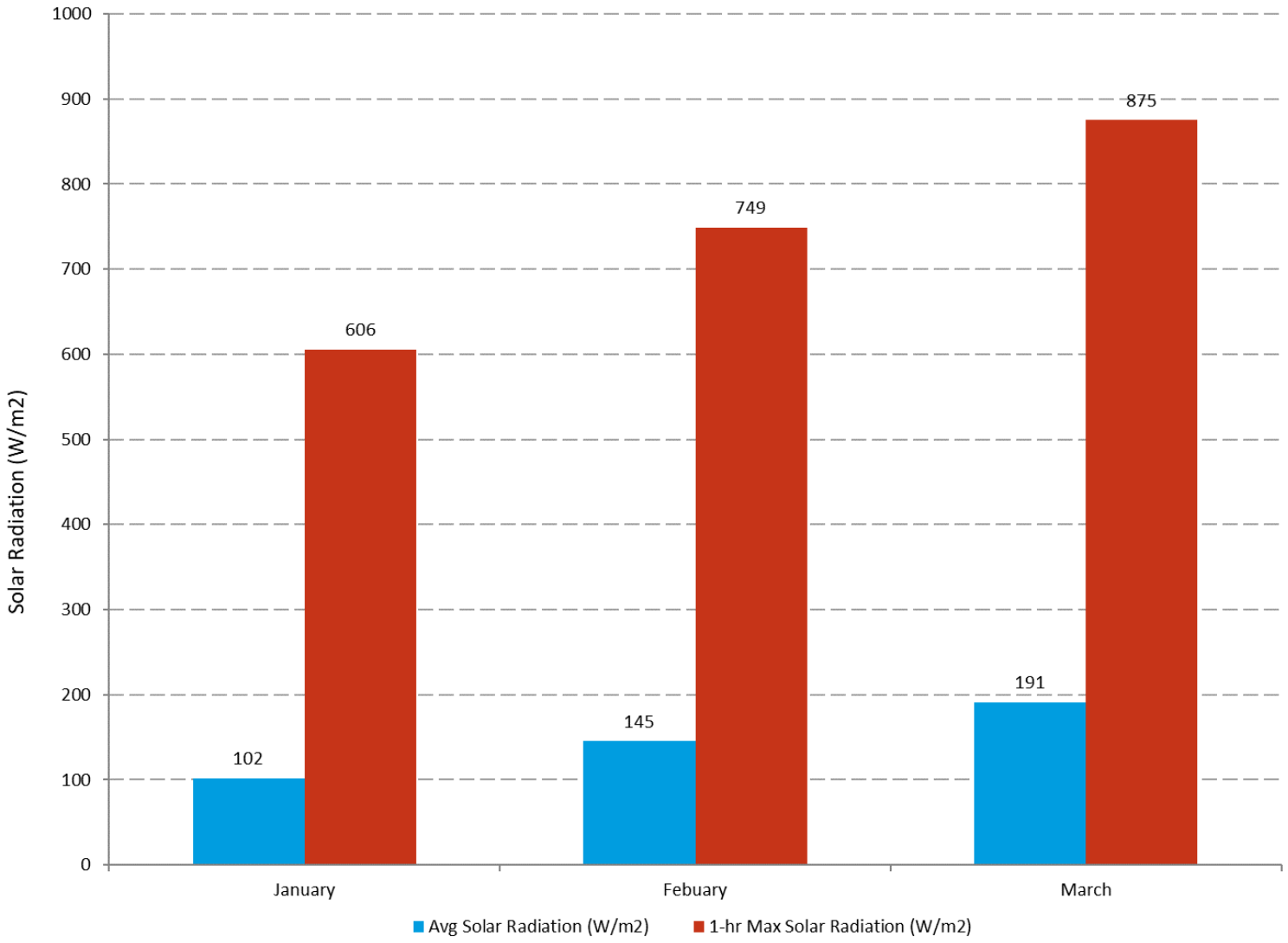

Figure 29. Hereford Q1 2025 Solar Radiation Summary

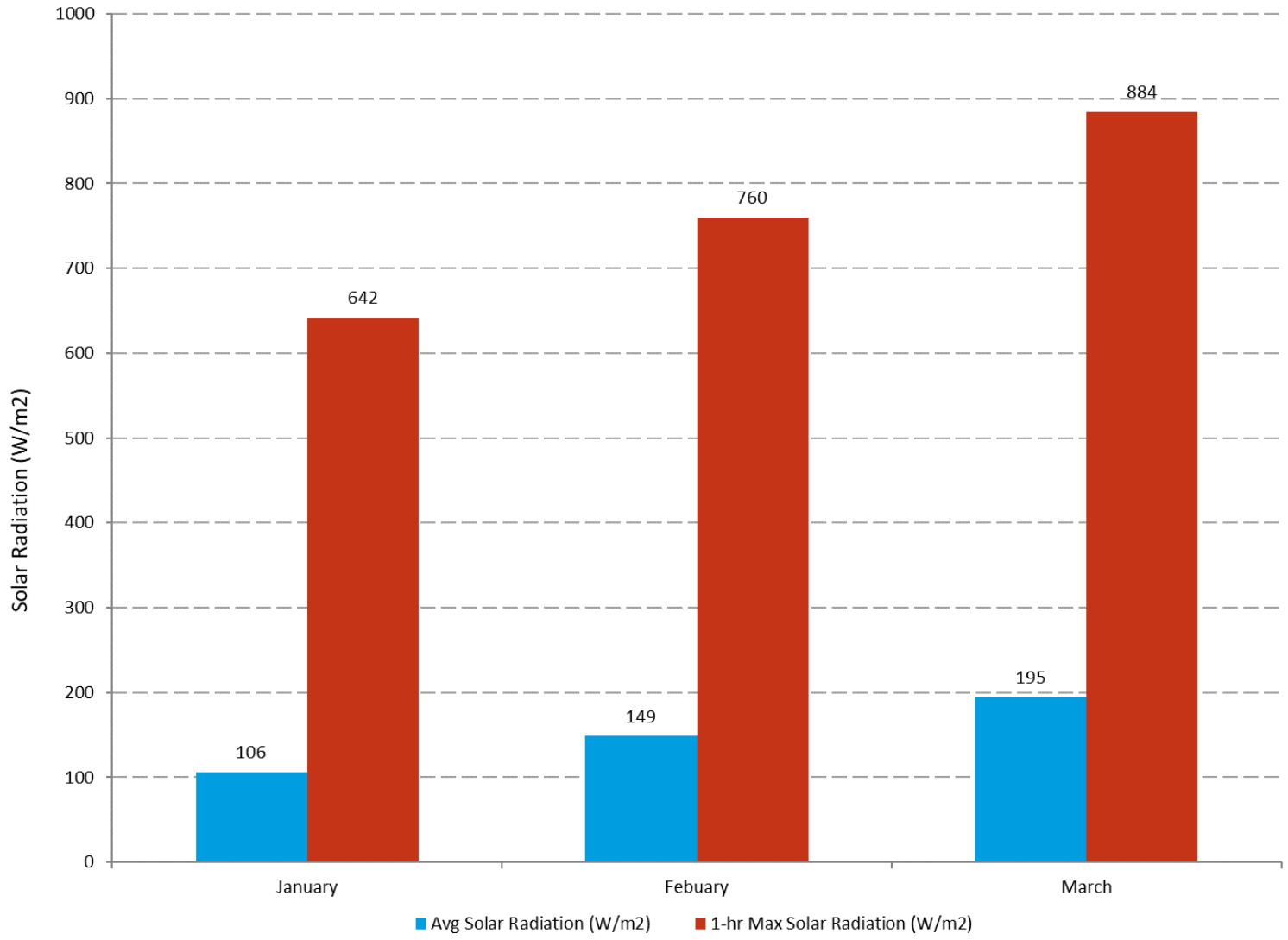

Figure 30. Orchard Q1 2025 Solar Radiation Summary

7. QUARTERLY REPORT DATA SUMMARY

Program activities conducted during Q1 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. 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. During Q1 2025, no site measured ozone above the 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 98th 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, with the exception of RH which was slightly lower as an average value than prior winter quarters. Temperatures were cooler than Q1 2024, but warmer than Q1 2023.

APPENDIX A: Q1 2025 CONTINGENCY CALIBRATION RESULTS

TABLE A-1
GAS CALIBRATION AS LEFT REPORT

AUDIT DATE: 1/2/2025
AUDITED BY: Abraham Dearden, Ramboll
SITE: Missile Site Park

ANALYZER DEVICE: TELEDYNE API T200 NOX ANALYZER RANGE = 0 - 500 PPB NOX
ANALYZER DEVICE: TELEDYNE API T400 O3 ANALYZER, RANGE 0 - 500 PPB O3
AUDIT DEVICE: TELEDYNE API T700 MULTI-GAS CALIBRATOR

Time Keeping	NO Audit												
	Calibration Gas Flows (LPM)			Audit Point	NO Audit Conc. (PPB)	NO_x Audit Conc. (PPB)	NO (PPB)	NO % diff.	NO_x (PPB)	NO_x % diff.	NO_2 (PPB)	NO_2 % diff.	NO_X Pass/Fail
Calibrations Start Time	Audit Gas		Zero Air										
10:46:00 AM	0.0000		6.0090	Zero	0.0	0.0	0.1	N/A	0.1	N/A	0.4	N/A	N/A
	0.0990		6.0060	2	50.4	50.6	49.2	-2.3	50.5	-0.1	1.1	N/A	PASS
	0.0198		5.9940	3	100.1	100.4	99.2	-0.9	100.3	-0.1	1.1	N/A	PASS
	0.0395		5.9750	4	200.3	201.0	199.5	-0.4	201.4	0.2	2.1	N/A	PASS
	0.0787		5.9340	5	399.4	400.7	400.7	0.3	405.7	1.3	4.8	N/A	PASS

	NO_2 Audit (Gas Phase Titration)											
	Calibration Gas Flows (LPM)			Audit Point	NO_2 Audit Conc. (PPB)	NO Audit Conc. (PPB)	NO Orig. (PPB)	NO rem. (PPB)	NO_x (PPB)	NO_2 (PPB)	NO_2 % diff.	Molybdenum Converter Efficiency (%); >96% = PASS	NO_2 Pass/Fail
	Audit Gas	Ozone	Zero Air										
	0.0000	0.0000	6.0090	Zero	0.0	0.0	N/A	0.1	0.1	0.4	N/A	97.7%	N/A
	0.0231	0.1050	6.8910	1 (40 PPB O_3)	41.7	100.3	99.2	57.5	101.0	43.3	3.9	PASS	PASS
Calibrations Stop Time	0.0461	0.1050	6.8690	2 (80 PPB O_3)	81.7	200.3	199.5	117.8	200.7	83.6	2.4		PASS
3:40:00 PM	0.0919	0.1050	6.8210	3 (160 PPB O_3)	165.1	399.7	400.7	235.7	403.5	167.4	1.4		PASS

Linear Regression

	NO	NO_X	NO_2 (GPT)	
Slope	1.004	1.013	1.011	
Intercept	-0.963	-0.839	0.814	
Correlation	1.0000	1.0000	1.0000	
Avg % diff.	-0.82	0.32	2.55	

Diagnostics

	T700	T400		T200	Audit Gas	
Serial Number	4969	5986	Serial Number	6727	Cylinder SN	EB0136191
O_3 Slope	0.9900	-	NO_x Slope	1.025	NO Conc (PPM)	30.5
O_3 Offset	0.6000	-	NO_x Offset	-0.5	NO_x Conc (PPM)	30.6
L3 O_3 Slope Correction Factor	1.0000		NO Slope	1.025	NO_2 Impurity (PPM)	0.1
L3 O_3 Offset Correction Factor	0.0000		NO Offset	-0.7		
Box Temp (C)	30.0	-	Box Temp (C)	31.2		
(Photo) Sample Temp (C)	39.8	-	HVPS (V)	536		
Ph. Lamp Temp (C)	58.0	-	Moly Conv Temp. (C)	316		
Ozone Gen Lamp Temp (C)	48.0		O_3 Flow (cc/min)	78.0		
Photo Flow (lpm)	0.715		PMT Temp. (C)	6.8		
Photo Press (in Hg)	24.2		Rx Cell Press (in Hg)	3.3		
Sample Flow (cc/min)		-	Rx Cell Temp (C)	50.00		
Sample Press (in Hg)		-	Sample Flow (cc/min)	525.0		
O_3 Ref (mV)	3341.6	-	Sample Press (in Hg)	23.7		

Key:

NO_2	Nitrogen Dioxide	%	Percent
NO_x	Oxides of Nitrogen	TAPI	Teledyne Advanced Pollution Instrumentation
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:

TABLE A-2
GAS CALIBRATION AS LEFT REPORT

AUDIT DATE: 2/5/2025
AUDITED BY: Jake Zaragoza, Ramboll
SITE: Missile Site Park

ANALYZER DEVICE: TELEDYNE API T200 NOX ANALYZER RANGE = 0 - 500 PPB NOX
ANALYZER DEVICE: TELEDYNE API T400 O3 ANALYZER, RANGE 0 - 500 PPB O3
AUDIT DEVICE: TELEDYNE API T700 MULTI-GAS CALIBRATOR

Time Keeping	NO Audit												
	Calibration Gas Flows (LPM)			Audit Point	NO Audit Conc. (PPB)	NO_x Audit Conc. (PPB)	NO (PPB)	NO % diff.	NO_x (PPB)	NO_x % diff.	NO_2 (PPB)	NO_2 % diff.	NO_X Pass/Fail
Calibrations Start Time	Audit Gas		Zero Air										
9:39:00 AM	0.0000		6.0080	Zero	0.0	0.0	0.4	N/A	0.8	N/A	0.6	N/A	N/A
	0.0116		7.0040	2	50.3	50.5	43.8	-12.9	44.5	-11.8	0.8	N/A	PASS
	0.0198		5.9960	3	100.2	100.5	89.0	-11.2	90.0	-10.4	1.1	N/A	FAIL
	0.0395		5.9730	4	200.4	201.1	181.7	-9.3	183.1	-8.9	1.7	N/A	FAIL
	0.0788		5.9360	5	399.3	400.6	373.9	-6.4	377.3	-5.8	3.2	N/A	FAIL

	NO_2 Audit (Gas Phase Titration)												
	Calibration Gas Flows (LPM)			Audit Point	NO_2 Audit Conc. (PPB)	NO Audit Conc. (PPB)	NO Orig. (PPB)	NO rem. (PPB)	NO_x (PPB)	NO_2 (PPB)	NO_2 % diff.	Molybdenum Converter Efficiency (%); >96% = PASS	NO_2 Pass/Fail
	Audit Gas	Ozone	Zero Air										
				Zero	0.0		N/A				N/A	99.6%	N/A
	0.0198	0.1050	5.8920	1 (40 PPB O_3)	37.0	100.2	89.0	52.0	89.2	37.3	0.8	PASS	PASS
Calibrations Stop Time	0.0395	0.1050	5.8720	2 (80 PPB O_3)	76.9	200.4	181.7	104.8	183.1	79.0	2.7		PASS
2:35:00 PM	0.0788	0.1050	5.8310	3 (160 PPB O_3)	157.4	399.3	373.9	216.5	376.2	159.6	1.4		PASS

Linear Regression

	NO	NO_X	NO_2 (GPT)	
Slope	0.938	0.943	1.014	
Intercept	-3.062	-2.766	0.251	
Correlation	0.9998	0.9998	0.9999	
Avg % diff.	-9.96	-9.25	1.63	

Diagnostics

	T700	T400		T200	Audit Gas	
Serial Number	4969	5986	Serial Number	6727	Cylinder SN	EB0136191
O_3 Slope	0.9900	-	NO_x Slope	1.025	NO Conc (PPM)	30.5
O_3 Offset	0.6000	-	NO_x Offset	-0.5	NO_x Conc (PPM)	30.6
L3 O_3 Slope Correction Factor	1.0000		NO Slope	1.025	NO_2 Impurity (PPM)	0.1
L3 O_3 Offset Correction Factor	0.0000		NO Offset	-0.7		
Box Temp (C)	30.0	-	Box Temp (C)			
(Photo) Sample Temp (C)	39.8	-	HVPS (V)			
Ph. Lamp Temp (C)	58.0	-	Moly Conv Temp. (C)			
Ozone Gen Lamp Temp (C)	48.0		O_3 Flow (cc/min)			
Photo Flow (lpm)	0.715		PMT Temp. (C)			
Photo Press (in Hg)	24.2		Rx Cell Press (in Hg)			
Sample Flow (cc/min)		-	Rx Cell Temp (C)			
Sample Press (in Hg)		-	Sample Flow (cc/min)			
O_3 Ref (mV)	3341.6	-	Sample Press (in Hg)			

Key:

NO_2	Nitrogen Dioxide	%	Percent
NO_x	Oxides of Nitrogen	TAPI	Teledyne Advanced Pollution Instrumentation
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:
Ozone cleanser media replacement, reaction cell cleaning, ozone flow orifice replacement, ozone flow orifice filter replacement following multi-point check

TABLE A-3
GAS CALIBRATION AS LEFT REPORT

AUDIT DATE: 2/7/2025
AUDITED BY: Jake Zaragoza, Ramboll
SITE: Missile Site Park

ANALYZER DEVICE: TELEDYNE API T200 NOX ANALYZER RANGE = 0 - 500 PPB NOX
ANALYZER DEVICE: TELEDYNE API T400 O3 ANALYZER, RANGE 0 - 500 PPB O3
AUDIT DEVICE: TELEDYNE API T700 MULTI-GAS CALIBRATOR

Time Keeping	NO Audit												
	Calibration Gas Flows (LPM)			Audit Point	NO Audit Conc. (PPB)	NO_x Audit Conc. (PPB)	NO (PPB)	NO % diff.	NO_x (PPB)	NO_x % diff.	NO_2 (PPB)	NO_2 % diff.	NO_X Pass/Fail
Calibrations Start Time	Audit Gas		Zero Air										
9:00:00 AM	0.0000		6.0110	Zero	0.0	0.0	0.1	N/A	0.1	N/A	0.1	N/A	N/A
	0.0116		7.0040	2	50.3	50.5	48.0	-4.5	48.6	-3.7	0.5	N/A	PASS
	0.0198		5.9950	3	100.3	100.6	98.4	-1.9	98.5	-2.1	0.1	N/A	PASS
	0.0395		5.9780	4	200.4	201.1	198.5	-0.9	199.5	-0.8	0.9	N/A	PASS
	0.0788		5.9390	5	399.2	400.5	400.0	0.2	401.1	0.2	1.5	N/A	PASS

	NO_2 Audit (Gas Phase Titration)											
	Calibration Gas Flows (LPM)			Audit Point	NO_2 Audit Conc. (PPB)	NO Audit Conc. (PPB)	NO Orig. (PPB)	NO rem. (PPB)	NO_x (PPB)	NO_2 (PPB)	NO_2 % diff.	Molybdenum Converter Efficiency (%); >96% = PASS	NO_2 Pass/Fail
	Audit Gas	Ozone	Zero Air										
	0.0000	0.0000	6.0110	Zero	0.0	0.0	N/A	0.1	0.1	0.1	N/A	99.2%	N/A
	0.0198	0.1050	5.8920	1 (40 PPB O_3)	41.1	100.3	98.4	57.3	98.1	40.9	-0.4	PASS	PASS
Calibrations Stop Time	0.0395	0.1050	5.8720	2 (80 PPB O_3)	84.1	200.3	198.5	114.4	197.9	84.2	0.1		PASS
2:50:00 PM	0.0788	0.1050	5.8330	3 (160 PPB O_3)	161.7	399.4	400.0	238.3	399.6	161.0	-0.4		PASS

Linear Regression

	NO	NO_X	NO_2 (GPT)
Slope	1.004	1.004	0.996
Intercept	-1.669	-1.492	0.161
Correlation	1.0000	1.0000	1.0000
Avg % diff.	-1.80	-1.60	-0.24

Diagnostics

	T700	T400		T200	Audit Gas	
Serial Number	4969	5986	Serial Number	6727	Cylinder SN	EB0136191
O_3 Slope	0.9900	-	NO_x Slope	1.07	NO Conc (PPM)	30.5
O_3 Offset	0.6000	-	NO_x Offset	-0.5	NO_x Conc (PPM)	30.6
L3 O_3 Slope Correction Factor	1.0000		NO Slope	1.077	NO_2 Impurity (PPM)	0.1
L3 O_3 Offset Correction Factor	0.0000		NO Offset	-0.7		
Box Temp (C)	29.6	-	Box Temp (C)	30.7		
(Photo) Sample Temp (C)	40.2	-	HVPS (V)	536		
Ph. Lamp Temp (C)	58.0	-	Moly Conv Temp. (C)	315.4		
Ozone Gen Lamp Temp (C)	48.0		O_3 Flow (cc/min)	78.0		
Photo Flow (lpm)	0.706		PMT Temp. (C)	6.8		
Photo Press (in Hg)	24.1		Rx Cell Press (in Hg)	3.3		
Sample Flow (cc/min)		-	Rx Cell Temp (C)	50.00		
Sample Press (in Hg)		-	Sample Flow (cc/min)	519.0		
O_3 Ref (mV)	4365.4	-	Sample Press (in Hg)	23.4		

Key:

NO_2	Nitrogen Dioxide	%	Percent
NO_x	Oxides of Nitrogen	TAPI	Teledyne Advanced Pollution Instrumentation
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:

TABLE A-4
GAS CALIBRATION AS FOUND REPORT

AUDIT DATE: 2/12/2025
AUDITED BY: Abraham Dearden, Ramboll
SITE: Missile Site Park

ANALYZER DEVICE: TELEDYNE API T200 NOX ANALYZER RANGE = 0 - 500 PPB NOX
ANALYZER DEVICE: TELEDYNE API T400 O3 ANALYZER, RANGE 0 - 500 PPB O3
AUDIT DEVICE: TELEDYNE API T700 MULTI-GAS CALIBRATOR

Time Keeping	NO Audit												
	Calibration Gas Flows (LPM)			Audit Point	NO Audit Conc. (PPB)	NO_x Audit Conc. (PPB)	NO (PPB)	NO % diff.	NO_x (PPB)	NO_x % diff.	NO_2 (PPB)	NO_2 % diff.	NO_X Pass/Fail
Calibrations Start Time	Audit Gas		Zero Air										
6:37:00 AM	0.0000		6.0070	Zero	0.0	0.0	0.1	N/A	0.4	N/A	0.4	N/A	N/A
	0.0099		6.0010	2	50.3	50.5	48.7	-3.2	49.4	-2.2	0.4	N/A	PASS
	0.0197		5.9950	3	100.2	100.5	98.1	-2.1	98.8	-1.8	0.8	N/A	PASS
	0.0395		5.9730	4	200.3	201.0	198.4	-1.0	199.9	-0.5	1.7	N/A	PASS
	0.0787		5.9340	5	399.4	400.7	396.4	-0.7	403.7	0.7	7.3	N/A	PASS

	NO_2 Audit (Gas Phase Titration)											
	Calibration Gas Flows (LPM)			Audit Point	NO_2 Audit Conc. (PPB)	NO Audit Conc. (PPB)	NO Orig. (PPB)	NO rem. (PPB)	NO_x (PPB)	NO_2 (PPB)	NO_2 % diff.	Molybdenum Converter Efficiency (%); >96% = PASS	NO_2 Pass/Fail
	Audit Gas	Ozone	Zero Air										
	0.0000	0.0000	6.0070	Zero	0.0	0.0	N/A	0.1	0.4	0.4	N/A	97.5%	N/A
	0.0198	0.1050	5.8920	1 (40 PPB O_3)	41.7	100.2	98.1	56.4	98.2	42.2	1.4	PASS	PASS
Calibrations Stop Time	0.0395	0.1050	5.8690	2 (80 PPB O_3)	80.9	200.5	198.4	117.5	197.6	80.7	-0.3		PASS
11:30:00 AM	0.0787	0.1050	5.8320	3 (160 PPB O_3)	157.0	399.4	396.4	239.4	400.1	160.5	2.2		PASS

Linear Regression				
	NO	NO_X	NO_2 (GPT)	
Slope	0.994	1.008	1.019	
Intercept	-0.828	-1.354	-0.281	
Correlation	1.0000	1.0000	0.9999	
Avg % diff.	-1.76	-0.93	1.12	

Diagnostics						
	T700	T400		T200	Audit Gas	
Serial Number	4969	5986	Serial Number	6727	Cylinder SN	EB0136191
O_3 Slope	0.9900	-	NO_x Slope	1.07	NO Conc (PPM)	30.5
O_3 Offset	0.6000	-	NO_x Offset	-0.5	NO_x Conc (PPM)	30.6
L3 O_3 Slope Correction Factor	1.0000		NO Slope	1.077	NO_2 Impurity (PPM)	0.1
L3 O_3 Offset Correction Factor	0.0000		NO Offset	-0.7		
Box Temp (C)	27.9	-	Box Temp (C)	29.5		
(Photo) Sample Temp (C)	38.5	-	HVPS (V)	536		
Ph. Lamp Temp (C)	58.0	-	Moly Conv Temp. (C)	315		
Ozone Gen Lamp Temp (C)	48.0		O_3 Flow (cc/min)	78.0		
Photo Flow (lpm)	0.000		PMT Temp. (C)	6.7		
Photo Press (in Hg)	24.8		Rx Cell Press (in Hg)	3.3		
Sample Flow (cc/min)		-	Rx Cell Temp (C)	50.00		
Sample Press (in Hg)		-	Sample Flow (cc/min)	522.0		
O_3 Ref (mV)	4318.9	-	Sample Press (in Hg)	23.4		

Key:

NO_2	Nitrogen Dioxide	%	Percent
NO_x	Oxides of Nitrogen	TAPI	Teledyne Advanced Pollution Instrumentation
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:
Ozone generator replaced. Ozone cleanser media replaced. Ozone flow orifice complete rebuild (new o-rings, filter, spring, and orifice). Reaction cell cleaned and new o-rings installed.

TABLE A-5
GAS CALIBRATION AS LEFT REPORT

AUDIT DATE: 2/14/2025
AUDITED BY: Abraham Dearden, Ramboll
SITE: Missile Site Park

ANALYZER DEVICE: TELEDYNE API T200 NOX ANALYZER RANGE = 0 - 500 PPB NOX
ANALYZER DEVICE: TELEDYNE API T400 O3 ANALYZER, RANGE 0 - 500 PPB O3
AUDIT DEVICE: TELEDYNE API T700 MULTI-GAS CALIBRATOR

Time Keeping	NO Audit												
	Calibration Gas Flows (LPM)			Audit Point	NO Audit Conc. (PPB)	NO_x Audit Conc. (PPB)	NO (PPB)	NO % diff.	NO_x (PPB)	NO_x % diff.	NO_2 (PPB)	NO_2 % diff.	NO_X Pass/Fail
Calibrations Start Time	Audit Gas		Zero Air										
8:53:00 AM	0.0000		6.0090	Zero	0.0	0.0	0.1	N/A	0.7	N/A	1.0	N/A	N/A
	0.0100		6.0030	2	50.1	50.3	47.6	-5.0	48.5	-3.5	0.9	N/A	PASS
	0.0198		5.9970	3	100.1	100.4	98.3	-1.8	98.7	-1.7	0.8	N/A	PASS
	0.0395		5.9730	4	200.3	201.0	199.1	-0.6	200.7	-0.1	1.8	N/A	PASS
	0.0787		5.9360	5	399.4	400.7	401.6	0.6	404.1	0.9	2.6	N/A	PASS

	NO_2 Audit (Gas Phase Titration)											
	Calibration Gas Flows (LPM)			Audit Point	NO_2 Audit Conc. (PPB)	NO Audit Conc. (PPB)	NO Orig. (PPB)	NO rem. (PPB)	NO_x (PPB)	NO_2 (PPB)	NO_2 % diff.	Molybdenum Converter Efficiency (%); >96% = PASS	NO_2 Pass/Fail
	Audit Gas	Ozone	Zero Air										
	0.0000	0.0000	6.0090	Zero	0.0	0.0	N/A	0.1	0.7	1.0	N/A	99.2%	N/A
	0.0198	0.1050	5.8920	1 (40 PPB O_3)	39.9	100.3	98.3	58.4	99.1	40.8	2.2	PASS	PASS
Calibrations Stop Time	0.0395	0.1050	5.8720	2 (80 PPB O_3)	80.1	200.4	199.1	119.0	199.9	81.6	1.9		PASS
3:30:00 PM	0.0788	0.1050	5.8310	3 (160 PPB O_3)	162.5	399.5	401.6	239.1	403.4	164.2	1.0		PASS

Linear Regression

	NO	NO_X	NO_2 (GPT)	
Slope	1.008	1.010	1.005	
Intercept	-1.889	-1.412	0.899	
Correlation	1.0000	1.0000	1.0000	
Avg % diff.	-1.72	-1.10	1.73	

Diagnostics

	T700	T400		T200	Audit Gas	
Serial Number	4969	5986	Serial Number	6727	Cylinder SN	EB0136191
O_3 Slope	0.9900	-	NO_x Slope	1.07	NO Conc (PPM)	30.5
O_3 Offset	0.6000	-	NO_x Offset	-0.5	NO_x Conc (PPM)	30.6
L3 O_3 Slope Correction Factor	1.0000		NO Slope	1.077	NO_2 Impurity (PPM)	0.1
L3 O_3 Offset Correction Factor	0.0000		NO Offset	-0.7		
Box Temp (C)		-	Box Temp (C)			
(Photo) Sample Temp (C)		-	HVPS (V)			
Ph. Lamp Temp (C)		-	Moly Conv Temp. (C)			
Ozone Gen Lamp Temp (C)			O_3 Flow (cc/min)			
Photo Flow (lpm)			PMT Temp. (C)			
Photo Press (in Hg)			Rx Cell Press (in Hg)			
Sample Flow (cc/min)		-	Rx Cell Temp (C)			
Sample Press (in Hg)		-	Sample Flow (cc/min)			
O_3 Ref (mV)		-	Sample Press (in Hg)			

Key:

NO_2	Nitrogen Dioxide	%	Percent
NO_x	Oxides of Nitrogen	TAPI	Teledyne Advanced Pollution Instrumentation
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:

TABLE A-6
GAS CALIBRATION AS LEFT REPORT

AUDIT DATE: 3/21/2025
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 T703 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		T703	T400
9:46:00 AM	Zero	0.00	0	0.41	N/A	N/A	Serial Number	4969	5986
	1	50.30	50.3	50.26	-0.1	PASS	O3 Slope	0.9900	1.040
	2	100.00	100	97.68	-2.3	PASS	O3 Offset	0.6000	0.60
	3	200.70	200.7	195.50	-2.6	PASS	L3 O3 Slope Correction Factor	1.0000	
Calibrations Stop Time	4	300.00	300	292.73	-2.4	PASS	L3 O3 Offset Correction Factor	0.0000	
11:14:00 AM	5	399.90	399.9	389.19	-2.7	PASS	Box Temp (C)	30.2	28.7
							(Photo) Sample Temp (C)	40.0	35.9
							Ph. Lamp Temp (C)	58.0	58.0
							Ozone Gen Lamp Temp (C)	48.0	
							Photo Flow (lpm)	0.697	
							Photo Press (in Hg)	24.9	
							Sample Flow (cc/min)		691
							Sample Press (in Hg)		22.5
							O3 Ref (mV)	4096.4	4199

Linear Regression	
	O3
Slope	0.972
Intercept	0.743
Correlation	1.0000
Avg % diff.	-2.02

Key:

NO_2	Nitrogen Dioxide	%	Percent
NO_x	Oxides of Nitrogen	TAPI	Teledyne Advanced Pollution Instrumentation
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: Response check following shift in overnight calibration checks.

APPENDIX B: Q1 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: the standard deviation of shelter temperature was above 2.1°C for the previous 24 hours	BC	Multi-point Calibration
AM	Miscellaneous Void	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				
January	Ozone/NO/NO2/NOx	AS	01/01/2025 01:00-01/02/2025 00:00	Poor quality assurance results – NO/NO2/NOx ONLY
		BD	01/01/2025 02:00	Overnight calibration – OZONE ONLY
		BD	01/02/2025 01:00-02:00	Overnight calibration
		V	01/02/2025 11:00	Value validated. Partial hour due to manual calibration.
		BC	01/02/2025 12:00-16:00	Multi-point calibration
		BD	01/03/2025 02:00	Overnight calibration
		BD	01/04/2025 02:00	Overnight calibration
		BD	01/05/2025 01:00-02:00	Overnight calibration
		BD	01/06/2025 02:00	Overnight calibration
		BD	01/07/2025 02:00	Overnight calibration
		BD	01/08/2025 02:00	Overnight calibration
		2	01/08/2025 06:00-16:00	Standard deviation of shelter temperature greater than 2.1°C
		2	01/08/2025 22:00-01/09/2025 05:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	01/09/2025 01:00-02:00	Overnight calibration
		BD	01/10/2025 02:00	Overnight calibration
		BD	01/11/2025 02:00	Overnight calibration
		BD	01/12/2025 01:00-02:00	Overnight calibration
		BD	01/13/2025 02:00	Overnight calibration
		BD	01/14/2025 02:00	Overnight calibration
		BD	01/15/2025 02:00	Overnight calibration
		BD	01/16/2025 01:00-02:00	Overnight calibration

		BD	01/17/2025 02:00	Overnight calibration
		BD	01/18/2025 02:00	Overnight calibration
		BD	01/19/2025 01:00-02:00	Overnight calibration
		BD	01/20/2025 02:00	Overnight calibration
		BD	01/21/2025 02:00	Overnight calibration
		V	01/21/2025 12:00	Value validated. Partial hour due to manual calibration.
		V	01/21/2025 13:00	Value validated. Partial hour due to manual calibration. – OZONE ONLY
		AT	01/21/2025 13:00	Manual calibration – NO/NO2/NOx ONLY
		BD	01/22/2025 02:00	Overnight calibration
		BD	01/23/2025 01:00-02:00	Overnight calibration
		BD	01/24/2025 02:00	Overnight calibration
		BD	01/25/2025 02:00	Overnight calibration
		AS	01/25/2025 03:00-02/01/2025 00:00	Poor Quality Assurance Results – NO/NO2/NOx ONLY
		BD	01/26/2025 01:00-02:00	Overnight calibration – OZONE ONLY
		BD	01/27/2025 02:00	Overnight calibration – OZONE ONLY
		2	01/27/2025 10:00-14:00	Standard deviation of shelter temperature greater than 2.1°C
		2	01/27/2025 23:00-01/28/2025 05:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	01/28/2025 02:00	Overnight calibration – OZONE ONLY
		AM	01/28/2025 15:00-16:00	Filter change
		BD	01/29/2025 02:00	Overnight calibration – OZONE ONLY
		BD	01/30/2025 01:00-02:00	Overnight calibration – OZONE ONLY
		BD	01/31/2025 02:00	Overnight calibration – OZONE ONLY
February	Precipitation	AT	02/25/2025 15:00-16:00	Calibration testing
	Ozone/NO/NO2/NOx	AS	02/01/2025 01:00-02/07/2025 09:00	Poor quality assurance results – NO/NO2/NOx ONLY
		BD	02/01/2025 02:00	Overnight calibration – OZONE ONLY
		BD	02/02/2025 01:00-02:00	Overnight calibration – OZONE ONLY

		BD	02/03/2025 02:00	Overnight calibration – OZONE ONLY
		AT	02/03/2025 11:00	Calibration testing – OZONE ONLY
		BD	02/04/2025 02:00	Overnight calibration – OZONE ONLY
		BD	02/05/2025 02:00	Overnight calibration – OZONE ONLY
		BC	02/05/2025 10:00-15:00	Multi-point calibration – OZONE ONLY
		V	02/05/2025 18:00	Value validated. Partial hour due to inlet work. – OZONE ONLY
		BD	02/06/2025 01:00-02:00	Overnight calibration – OZONE ONLY
		V	02/06/2025 12:00	Value validated. Partial hour due to calibration testing. – OZONE ONLY
		AT	02/06/2025 13:00	Calibration testing – OZONE ONLY
		V	02/06/2025 14:00	Value validated. Partial hour due to calibration testing. – OZONE ONLY
		BD	02/07/2025 02:00	Overnight calibration – OZONE ONLY
		BC	02/07/2025 10:00-15:00	Multi-point calibration
		BD	02/08/2025 02:00	Overnight calibration
		BD	02/09/2025 01:00-02:00	Overnight calibration
		BD	02/10/2025 02:00	Overnight calibration
		BD	02/11/2025 02:00	Overnight calibration
		BD	02/12/2025 02:00	Overnight calibration
		BC	02/12/2025 07:00-12:00	Multi-point calibration
		AS	02/12/2025 13:00-02/14/2025 09:00	Poor quality assurance results – NO/NO2/NOx ONLY
		V	02/12/2025 14:00	Value validated. Partial hour due to inlet maintenance. – OZONE ONLY
		V	02/12/2025 17:00	Value validated. Partial hour due to inlet maintenance. – OZONE ONLY
		BD	02/13/2025 01:00-02:00	Overnight calibration – OZONE ONLY
		2	02/13/2025 09:00-13:00	Standard deviation of shelter temperature greater than 2.1°C

		2	02/13/2025 20:00-02/14/2025 04:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	02/14/2025 02:00	Overnight calibration – OZONE ONLY
		V	02/14/2025 09:00	Value validated. Partial hour due to multi-point calibration – OZONE ONLY
		BC	02/14/2025 10:00-16:00	Multi-point calibration
		BD	02/15/2025 02:00	Overnight calibration
		BD	02/16/2025 01:00-02:00	Overnight calibration
		2	02/16/2025 07:00-10:00	Standard deviation of shelter temperature greater than 2.1°C
		2	02/16/2025 21:00-02/17/2025 05:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	02/17/2025 02:00	Overnight calibration
		BD	02/18/2025 02:00	Overnight calibration
		BD	02/19/2025 02:00	Overnight calibration
		2	02/19/2025 21:00-02/20/2025 00:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	02/20/2025 01:00-02:00	Overnight calibration
		2	02/20/2025 20:00-02/21/2025 05:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	02/21/2025 02:00	Overnight calibration
		BD	02/22/2025 02:00	Overnight calibration
		BD	02/23/2025 01:00-02:00	Overnight calibration
		BD	02/24/2025 02:00	Overnight calibration
		BD	02/25/2025 02:00	Overnight calibration
		AM	02/25/2025 15:00-16:00	Filter change
		BD	02/26/2025 02:00	Overnight calibration
		BD	02/27/2025 01:00-02:00	Overnight calibration
		BD	02/28/2025 02:00	Overnight calibration
March	Ozone/NO/NO2/NOx	BD	03/01/2025 02:00	Overnight calibration
		BD	03/02/2025 01:00-02:00	Overnight calibration
		BD	03/03/2025 02:00	Overnight calibration
		BD	03/04/2025 02:00	Overnight calibration
		BD	03/05/2025 02:00	Overnight calibration
		BD	03/06/2025 01:00-02:00	Overnight calibration
		BD	03/07/2025 02:00	Overnight calibration

		V	03/07/2025 11:00	Value validated. Partial hour due to calibration testing.
		AT	03/07/2025 12:00	Calibration testing
		V	03/07/2025 13:00	Value validated. Partial hour due to calibration testing.
		BD	03/08/2025 02:00	Overnight calibration
		AV	03/09/2025 00:00-01:00	Power failure
		AV	03/09/2025 02:00	Power failure – NO/NO2/NOx ONLY
		V	03/09/2025 02:00	Value validated. Partial hour due to power failure – OZONE ONLY
		BD	03/10/2025 02:00	Overnight calibration
		V	03/10/2025 15:00	Value validated. Partial hour due to calibration testing.
		BD	03/11/2025 02:00	Overnight calibration
		BD	03/12/2025 02:00	Overnight calibration
		BD	03/13/2025 01:00-02:00	Overnight calibration
		BD	03/14/2025 02:00	Overnight calibration
		BD	03/15/2025 02:00	Overnight calibration
		BD	03/16/2025 01:00-02:00	Overnight calibration
		BD	03/17/2025 02:00	Overnight calibration
		BD	03/18/2025 02:00	Overnight calibration
		BD	03/19/2025 02:00	Overnight calibration
		BD	03/20/2025 01:00-02:00	Overnight calibration
		BD	03/21/2025 02:00	Overnight calibration
		V	03/21/2025 10:00	Value validated. Partial hour due to multi-point calibration.
		BC	03/21/2025 11:00-12:00	Multi-point calibration
		BD	03/22/2025 02:00	Overnight calibration
		BD	03/23/2025 01:00-02:00	Overnight calibration
		BD	03/24/2025 02:00	Overnight calibration
		V	03/24/2025 15:00-16:00	Value validated. Partial hours due to power failure.
		BD	03/25/2025 02:00	Overnight calibration
		V	03/25/2025 08:00	Value validated. Partial hour due to filter change.
		AM	03/25/2025 09:00	Filter change
		BD	03/26/2025 02:00	Overnight calibration
		BD	03/27/2025 01:00-02:00	Overnight calibration

		BD	03/28/2025 02:00	Overnight calibration
		BD	03/29/2025 02:00	Overnight calibration
		BD	03/30/2025 01:00-02:00	Overnight calibration
		BD	03/31/2025 02:00	Overnight calibration
Hereford				
January	Ozone	BD	01/01/2025 02:00	Overnight calibration
		BD	01/03/2025 02:00	Overnight calibration
		BD	01/06/2025 02:00	Overnight calibration
		BD	01/08/2025 02:00	Overnight calibration
		BD	01/10/2025 02:00	Overnight calibration
		BD	01/13/2025 02:00	Overnight calibration
		BD	01/15/2025 02:00	Overnight calibration
		BD	01/17/2025 02:00	Overnight calibration
		BD	01/20/2025 02:00	Overnight calibration
		BD	01/22/2025 02:00	Overnight calibration
		BD	01/24/2025 02:00	Overnight calibration
		BD	01/27/2025 02:00	Overnight calibration
		V	01/28/2025 11:00	Value validated. Partial hour due to filter change.
		AM	01/28/2025 12:00	Filter change
		BD	01/29/2025 02:00	Overnight calibration
		BD	01/31/2025 02:00	Overnight calibration
February	Ozone	BD	02/03/2025 02:00	Overnight calibration
		BD	02/05/2025 02:00	Overnight calibration
		BD	02/07/2025 02:00	Overnight calibration
		BD	02/10/2025 02:00	Overnight calibration
		BD	02/12/2025 02:00	Overnight calibration
		BD	02/14/2025 02:00	Overnight calibration
		BD	02/17/2025 02:00	Overnight calibration
		BD	02/19/2025 02:00	Overnight calibration
		BD	02/21/2025 02:00	Overnight calibration
		BD	02/24/2025 02:00	Overnight calibration
		AM	02/25/2025 12:00	Filter change
		V	02/25/2025 13:00	Value validated. Partial hour due to filter change.
		BD	02/26/2025 02:00	Overnight calibration
		BD	02/28/2025 02:00	Overnight calibration
		2	02/28/2025 09:00-14:00	Standard deviation of shelter temperature greater than 2.1°C
March	Ozone	2	03/01/2025 23:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/03/2025 02:00	Overnight calibration
		2	03/03/2025 06:00	Standard deviation of shelter temperature greater than 2.1°C

		2	03/03/2025 08:00-09:00	Standard deviation of shelter temperature greater than 2.1°C
		2	03/03/2025 16:00-17:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/05/2025 02:00	Overnight calibration
		BD	03/07/2025 02:00	Overnight calibration
		2	03/09/2025 21:00-03/10/2025 02:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/10/2025 02:00	Overnight calibration
		2	03/11/2025 10:00-18:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/12/2025 02:00	Overnight calibration
		2	03/12/2025 22:00-03/13/2025 01:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/14/2025 02:00	Overnight calibration
		BD	03/17/2025 02:00	Overnight calibration
		2	03/17/2025 20:00-03/18/2025 02:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/19/2025 02:00	Overnight calibration
		BD	03/21/2025 02:00	Overnight calibration
		BD	03/24/2025 02:00	Overnight calibration
		2	03/24/2025 22:00-03/25/2025 12:00	Standard deviation of shelter temperature greater than 2.1°C
		V	03/25/2025 12:00	Value validated. Partial hour due to filter change.
		AM	03/25/2025 13:00	Filter change
		2	03/25/2025 14:00-19:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/26/2025 02:00	Overnight calibration
		BD	03/28/2025 02:00	Overnight calibration
		BD	03/31/2025 02:00	Overnight calibration
Orchard				
January	Ozone	BD	01/01/2025 02:00	Overnight calibration
		BD	01/03/2025 02:00	Overnight calibration
		BD	01/06/2025 02:00	Overnight calibration
		BD	01/08/2025 02:00	Overnight calibration
		BD	01/10/2025 02:00	Overnight calibration
		BD	01/13/2025 02:00	Overnight calibration
		BD	01/15/2025 02:00	Overnight calibration
		BD	01/17/2025 02:00	Overnight calibration
		BD	01/20/2025 02:00	Overnight calibration
		BD	01/22/2025 02:00	Overnight calibration
		BD	01/24/2025 02:00	Overnight calibration
		BD	01/27/2025 02:00	Overnight calibration

		AM	01/28/2025 13:00-14:00	Filter change
		BD	01/29/2025 02:00	Overnight calibration
		BD	01/31/2025 02:00	Overnight calibration
February	Ozone	2	02/02/2025 22:00-02/03/2025 01:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	02/03/2025 02:00	Overnight calibration
		BD	02/05/2025 02:00	Overnight calibration
		BD	02/07/2025 02:00	Overnight calibration
		BD	02/10/2025 02:00	Overnight calibration
		BD	02/12/2025 02:00	Overnight calibration
		BD	02/14/2025 02:00	Overnight calibration
		AT	02/14/2025 13:00	Manual calibration
		V	02/14/2025 14:00	Value validated. Partial hour due to manual calibration.
		BD	02/17/2025 02:00	Overnight calibration
		BD	02/19/2025 02:00	Overnight calibration
		BD	02/21/2025 02:00	Overnight calibration
		V	02/21/2025 13:00-14:00	Value validated. Partial hour due to calibration testing.
		2	02/23/2025 19:00-02/24/2025 05:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	02/24/2025 02:00	Overnight calibration
		2	02/25/2025 04:00-02/26/2025 16:00	Standard deviation of shelter temperature greater than 2.1°C
		V	02/25/2025 13:00	Value validated. Partial hour due to filter change.
		AM	02/25/2025 14:00	Filter change.
		BD	02/26/2025 02:00	Overnight calibration
		2	02/27/2025 20:00-03/01/2025 00:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	02/28/2025 02:00	Overnight calibration
March	Ozone	2	03/01/2025 01:00-03/04/2025 07:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/03/2025 02:00	Overnight calibration
		2	03/04/2025 11:00-15:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/05/2025 02:00	Overnight calibration
		2	03/05/2025 21:00-03/06/2025 02:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/07/2025 02:00	Overnight calibration
		2	03/09/2025 18:00-03/12/2025 08:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/10/2025 02:00	Overnight calibration
		BD	03/12/2025 02:00	Overnight calibration
		BD	03/14/2025 02:00	Overnight calibration

		2	03/14/2025 14:00-19:00	Standard deviation of shelter temperature greater than 2.1°C
		2	03/16/2025 20:00-03/17/2025 07:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/17/2025 02:00	Overnight calibration
		2	03/17/2025 22:00-03/18/2025 04:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/19/2025 02:00	Overnight calibration
		2	03/19/2025 06:00-13:00	Standard deviation of shelter temperature greater than 2.1°C
		2	03/20/2025 20:00-03/21/2025 03:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/21/2025 02:00	Overnight calibration
		2	03/21/2025 15:00-03/22/2025 03:00	Standard deviation of shelter temperature greater than 2.1°C
		2	03/23/2025 03:00-03/24/2025 03:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/24/2025 02:00	Overnight calibration
		V	03/24/2025 11:00-12:00	Value validated. Partial hour due to calibration testing.
		AM	03/25/2025 13:00-14:00	Filter change.
		BD	03/26/2025 02:00	Overnight calibration
		BD	03/28/2025 02:00	Overnight calibration
		2	03/30/2025 08:00-14:00	Standard deviation of shelter temperature greater than 2.1°C
		BD	03/31/2025 02:00	Overnight calibration
		2	03/31/2025 21:00-04/01/2025 00:00	Standard deviation of shelter temperature greater than 2.1°C

APPENDIX B2: CORRECTIVE ACTION REPORT

CORRECTIVE ACTION REPORT NO.: 32

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

Problem Identification		
Site (Location):	**Missile Site Park**	
System or Instrumentation:	**Teledyne API T200 NO/NO2/NOx**	
Estimated start date/time	**1/25/2025**	
Problem identified by:	**Mike Ring**	
Problem definition: • **Parameter (s) affected**	**A shift in NO/NO2/NOx response was noticed on the 2/1 routine nightly check. After review of nightly checks, it was determined that the issue began around 1/25. Despite the shift, zero/span/precision and precision and span gas-phase titration checks were within critical criteria. A multi-point check was performed on 2/5 as part of a planned 'as found/as left' so that analyzer maintenance could be performed in response to the shift. The multi-point 'as found' check on 2/5 did not pass.** • **NO/NO2/NOx**	
Planned corrective actions (if necessary):	**Analyzer maintenance and calibration (if necessary)**	
	Expected Completion Date:	**2/14/2025**

Problem Resolution	
Date corrective action taken:	**2/5, 2/7, 2/12, and 2/14/2025**
Action taken by:	**Jake Zaragoza & Abe Dearden**
Corrective action taken:	**Following the multi-point check on 2/5, an emergency visit was made on the same day to perform maintenance. The ozone cleanser media was replaced, and the reaction cell was cleaned. On 2/7 a multi-point check was performed with passing results. Data were invalidated between 1/25 and 2/7. The 2/5 visit was intended to be a temporary fix, another multi-point was performed on 2/12 with passing results. That same day, a site visit was made to replace the ozone generator, replace the ozone cleanser media, clean the reaction cell, and rebuild the ozone flow orifice to the reaction cell. On 2/14, a final multi-point check was performed with passing results. Data were invalidated between the 2/12 and 2/14 multi-point checks.**

Effectiveness of corrective actions: ☒ **Yes, it was resolved** ☐ **No, it was NOT resolved**

Corrective Action Report Author & Date	Signature
Prepared by: Jake Zaragoza **Date: 2/18/2025**	
QA Officer: Michael Ring **Date: 2/20/2025**	

APPENDIX C: Q1 2025 SITE VISITATION LOGS

Missile Site Park Site Access Log								
Name	Date	Arrival	Departure	Last Filter change		Pump off	Pump on	Notes
				NOx	Ozone			
Dearden (Remote)	1/2/2025	10:46	15:40					Remote multipoint calibration for NO/NO2/NOx. Passing results, all gasses offline.
Dearden (Remote)	1/21/2025	11:46	12:22					Remote manual calibration for Ozone. Passing results, all gasses offline. Ozone stable by 12:15, NO/NO2/NOx stable by 12:22.
Clemments	1/28/2025	14:12	14:50	1/28/2025	1/28/2025	14:41	14:46	Filters swaped. NADP and AMoN samples retrieved and set up.
Dearden (Remote)	2/3/2025	10:13	11:00					Manual calibration for NOx. Gasses offline.
Zaragoza (Remote)	2/5/2025	9:39	14:35					NOx multi-point 'as found' calibration.
Zaragoza	2/5/2025	15:43	17:20					NOx maintenance: ozone cleanser media replacement, rxn cell cleaning, ozone flow orifice sintered filter and spring replacement. Spring showed signs of corrosion. NOx down from 15:43 to 17:19. NOx leak check (ozone impacted as well) from 17:17-17:19.
Zaragoza (remote)	2/6/2025	11:54	13:12					ZSP attempt.
Zaragoza (remote)	2/7/2025	9:00	14:50					NOx multi-point 'as left' calibration.
Dearden (Remote)	2/12/2025	6:37	11:30					NOx multi-point 'as found' calibration.
Zaragoza	2/12/2025	13:32	16:10					NOx maintenance work. Analyzer off at 13:33. Ozone generator replaced. Ozone cleanser media replaced. Ozone flow orifice rebuild with 4 new o-rings, new sintered filter, new spring, new orifice. Reaction cell cleaned and reaction cell o-rings replaced. NOx post maintenance leak check at 16:02. NOx down from 13:33 to 16:03. Ozone affected for 1 minute at 13:33 and 16:03.
Dearden (Remote)	2/14/2025	8:53	15:30					NOx multi-point 'as left' calibration.
Clemments	2/25/2025	14:08	14:32	2/25/2025	2/25/2025	14:32	14:36	Filter changes: Test rain gauge at 14:43-14:50. Took bucket off, cleared dipper/tipper of wire: test rain gauge again at 15:01. Rain gauge okay now.
Zaragoza (remote)	3/7/2025	10:46	12:12					Diluent flow doesn't hit target, it is low but difference is made up with cal flow. Cal flow should be zero. Ozone response is 15 ppb lower than T700. Ozone analyzer flow varies by 15 cc/min. NO span check flows are nominal. During GPT present of 400 NO and 160 ozone, ozone analyzer registered correct concentration. GPT check looked ok. Re-ran ozone span, and diluent flow doesn't hit target, but no cal flow this time. Ozone response now tracks with T700. Gases offline from 10:46 to 12:12.
Zaragoza (remote)	3/10/2025	14:06	14:17					Calibration testing. Times in standard time. Gases offline from 14:06-14:17.
Zaragoza (remote)	3/21/2025	9:46	11:17					Ozone multi-point to test linearity. Gases offline from 9:46 to 11:17.
Clemments	3/25/2025	8:30	10:00	3/25/2025	3/25/2025	8:47	8:53	Filter changes for O3 and NOx.

Hereford Site Access Log							
Name	**Date**	**Arrival**	**Departure**	**Last Filter change**	**Pump off**	**Pump on**	**Notes**
				Ozone			
Clemments	1/28/2025	10:44	11:00	1/28/2025	10:50	10:53	Desiccant change and filter change.
Clemments	2/25/2025	10:55	11:11	2/25/2025	11:04	11:06	Desiccant change and filter change.
Clemments	3/25/2025	12:38	12:58	3/25/2025	12:49	12:51	Desiccant change and filter change.

Missile Site Park Site Access Log								
Name	**Date**	**Arrival**	**Departure**	**Last Filter change**		**Pump off**	**Pump on**	**Notes**
				NOx	Ozone			
Dearden (Remote)	1/2/2025	10:46	15:40					Remote multipoint calibration for NO/NO2/NOx. Passing results, all gasses offline.
Dearden (Remote)	1/21/2025	11:46	12:22					Remote manual calibration for Ozone. Passing results, all gasses offline. Ozone stable by 12:15, NO/NO2/NOx stable by 12:22.
Clemments	1/28/2025	14:12	14:50	1/28/2025	1/28/2025	14:41	14:46	Filters swaped. NADP and AMoN samples retrieved and set up.
Dearden (Remote)	2/3/2025	10:13	11:00					Manual calibration for NOx. Gasses offline.
Zaragoza (Remote)	2/5/2025	9:39	14:35					NOx multi-point 'as found' calibration.
Zaragoza	2/5/2025	15:43	17:20					NOx maintenance: ozone cleanser media replacement, rxn cell cleaning, ozone flow orifice sintered filter and spring replacement. Spring showed signs of corrosion. NOx down from 15:43 to 17:19. NOx leak check (ozone impacted as well) from 17:17-17:19.
Zaragoza (remote)	2/6/2025	11:54	13:12					ZSP attempt.
Zaragoza (remote)	2/7/2025	9:00	14:50					NOx multi-point 'as left' calibration.
Dearden (Remote)	2/12/2025	6:37	11:30					NOx multi-point 'as found' calibration.
Zaragoza	2/12/2025	13:32	16:10					NOx maintenance work. Analyzer off at 13:33. Ozone generator replaced. Ozone cleanser media replaced. Ozone flow orifice rebuild with 4 new o-rings, new sintered filter, new spring, new orifice. Reaction cell cleaned and reaction cell o-rings replaced. NOx post maintenance leak check at 16:02. NOx down from 13:33 to 16:03. Ozone affected for 1 minute at 13:33 and 16:03.
Dearden (Remote)	2/14/2025	8:53	15:30					NOx multi-point 'as left' calibration.
Clemments	2/25/2025	14:08	14:32	2/25/2025	2/25/2025	14:32	14:36	Filter changes: Test rain gauge at 14:43-14:50. Took bucket off, cleared dipper/tipper of wire: test rain gauge again at 15:01. Rain gauge okay now.
Zaragoza (remote)	3/7/2025	10:46	12:12					Diluent flow doesn't hit target, it is low but difference is made up with cal flow. Cal flow should be zero. Ozone response is 15 ppb lower than T700. Ozone analyzer flow varies by 15 cc/min. NO span check flows are nominal. During GPT present of 400 NO and 160 ozone, ozone analyzer registered correct concentration. GPT check looked ok. Re-ran ozone span, and diluent flow doesn't hit target, but no cal flow this time. Ozone response now tracks with T700. Gases offline from 10:46 to 12:12.
Zaragoza (remote)	3/10/2025	14:06	14:17					Calibration testing. Times in standard time. Gases offline from 14:06-14:17.
Zaragoza (remote)	3/21/2025	9:46	11:17					Ozone multi-point to test linearity. Gases offline from 9:46 to 11:17.
Clemments	3/25/2025	8:30	10:00	3/25/2025	3/25/2025	8:47	8:53	Filter changes for O3 and NOx.

APPENDIX D: Q1 2025 CALIBRATION STATISTICS

APPENDIX D: Q1 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. 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.

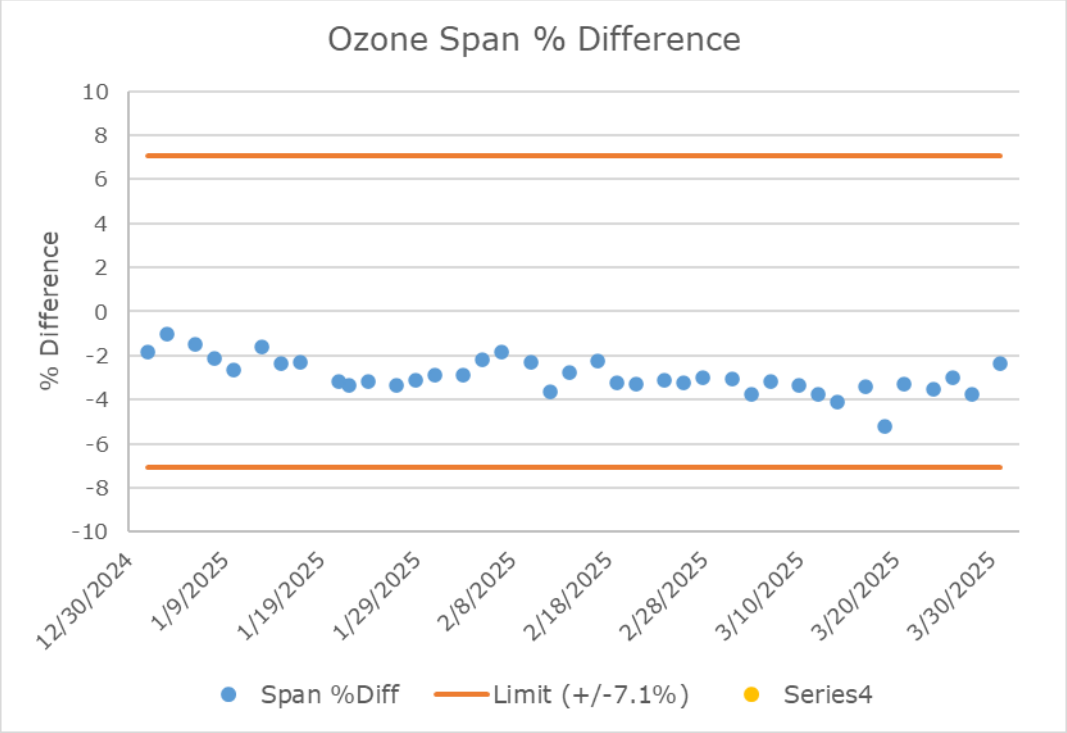

Figure D - 1. 2025 Q1 Calibration span percent difference for O_3 at Missile Site Park.

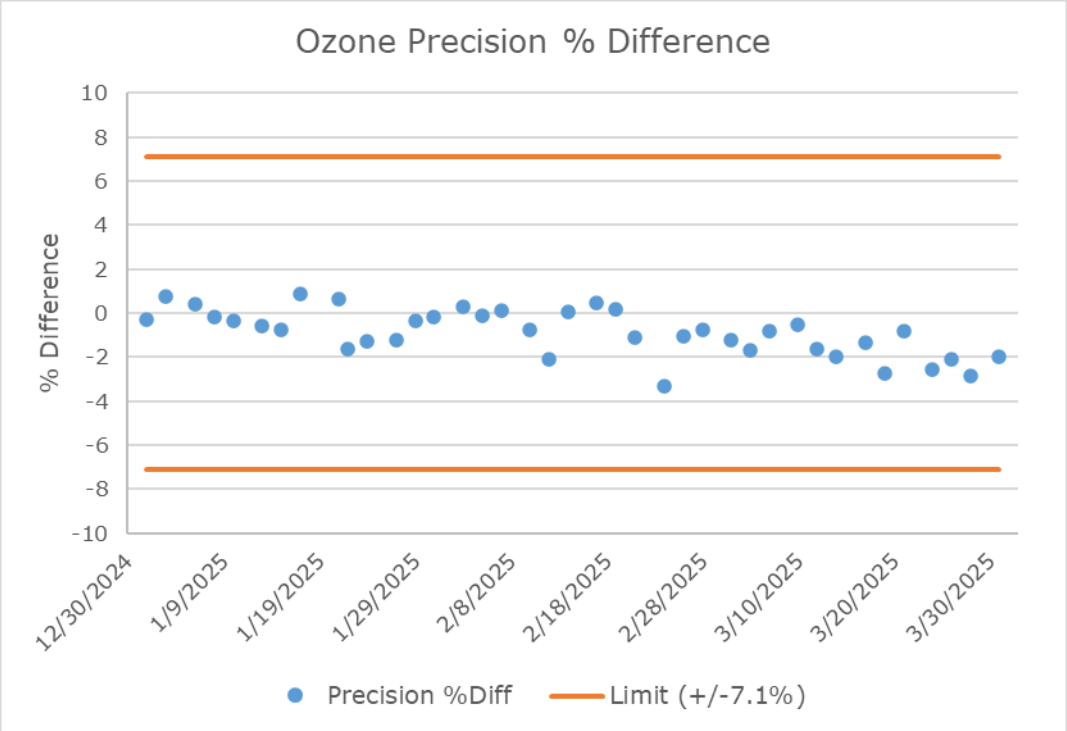

Figure D - 2. 2025 Q1 Calibration precision percent difference for O_3 at Missile Site Park.

Table D - 1. Summary of 2025 Q1 calibration statistics for O_3 at Missile Site Park.

Formula	Precision	Span
STDEV	1.06	0.79
Count	39	39
Chi^2, 0.1, n-1	27.34	27.34
CV	1.25	0.94
Bias	1.31	3.14
Bias (+/-/U)	-	-
AB	1.08	2.92
AS	0.85	0.79
$t_{0.95}$, n-1	1.69	1.69
25th	-1.63	-3.33
75th	-0.14	-2.33

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. Calibrations on January 28th, February 1st, and February 4th were invalidated due to a shift in analyzer response and are not included. Data is also invalid from January 25th through February 7th and February 12th through February 14th. All other calibration checks were 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. Note that **Table D - 2** does not include calibration data from periods that were invalidated.

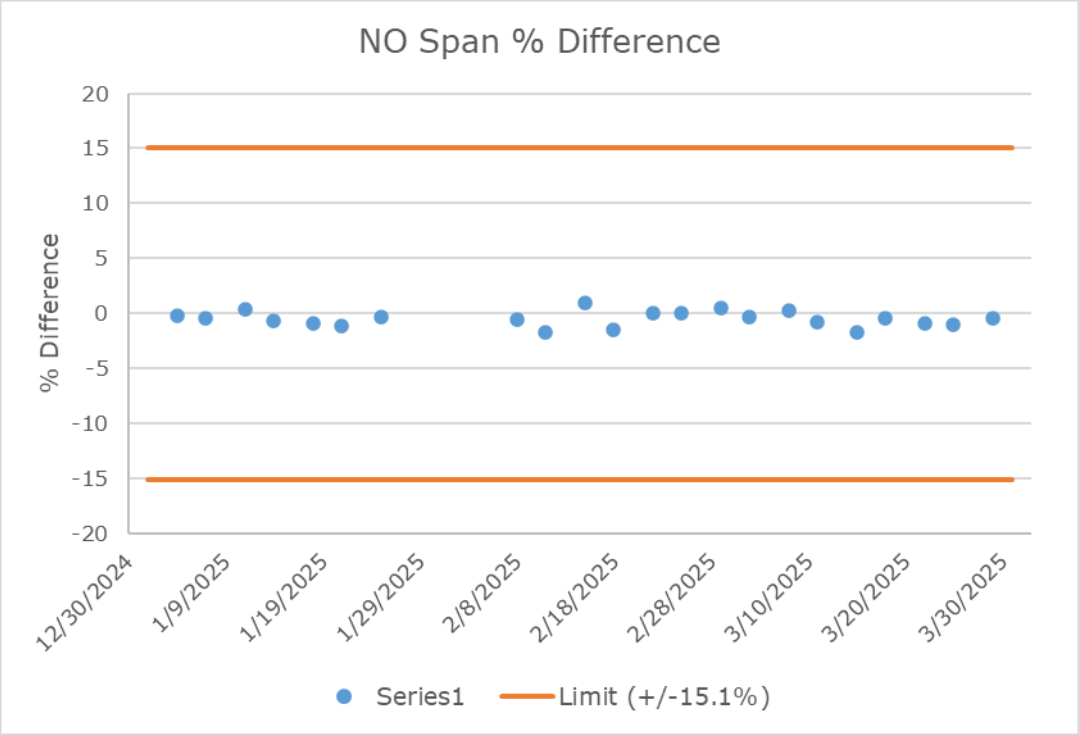

Figure D - 3. 2025 Q1 Calibration span percent difference for NO at Missile Site Park.

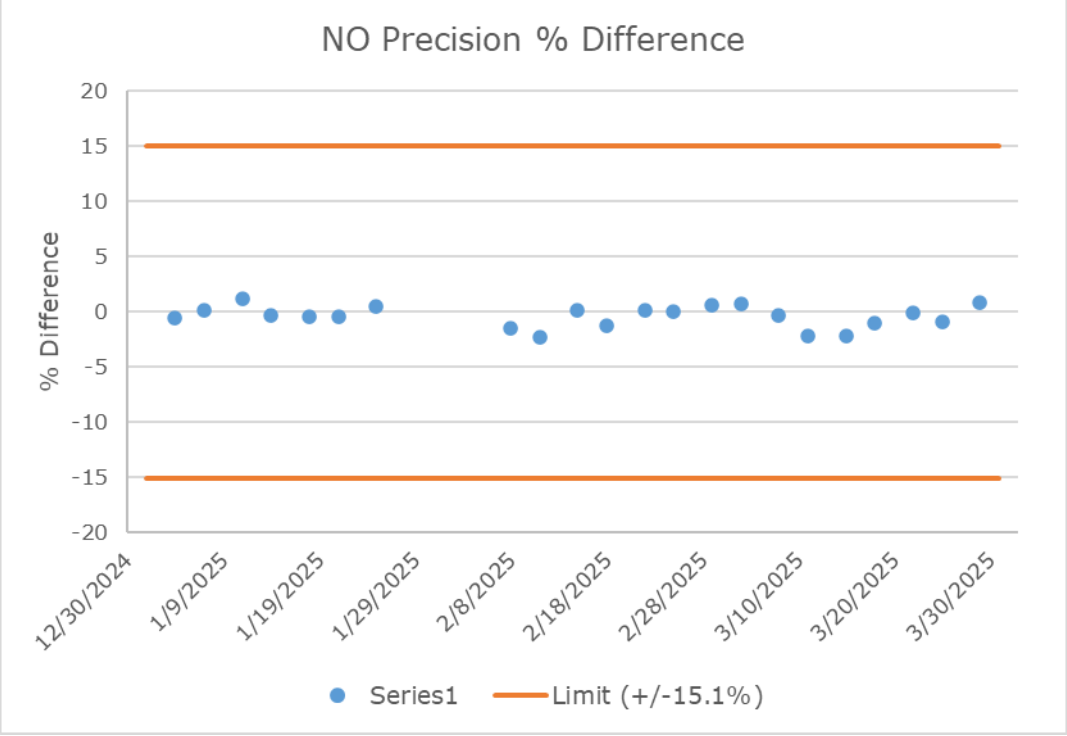

Figure D - 4. 2025 Q1 Calibration precision percent difference for NO at Missile Site Park.

Table D - 2. Summary of 2025 Q1 calibration statistics for NO at Missile Site Park.

Formula	Precision	Span
STDEV	1.01	0.69
Count	22	22
Chi^2, 0.1, n-1	13.24	13.24
CV	1.27	0.87
Bias	1.08	0.88
Bias (+/-/U)	U	-
AB	0.82	0.70
AS	0.70	0.49
$t_{0.95}$, n-1	1.72	1.72
25th	-1.05	-0.89
75th	0.16	-0.08

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. In Q1 2025, the four additional multi-point calibrations that occurred yielded CE values of 97.7%, 99.2%, 97.5%, and 99.2%.

Figure D - 6 and **Figure D - 7** below show the calibration percent difference for NO_2 during span and precision calibrations, respectively. Calibrations on January 26th, January 30th, February 2nd, February 6th, and February 13th were invalidated due to a shift in analyzer response and are not included. Data is also invalid from January 25th through February 7th and February 12th through February 14th. Additionally, a NO_2 span calibration check on March 9th did not occur due to a power failure. All valid calibration checks were 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. Note that **Table D - 2** does not include calibration data from periods that were invalidated.

[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.

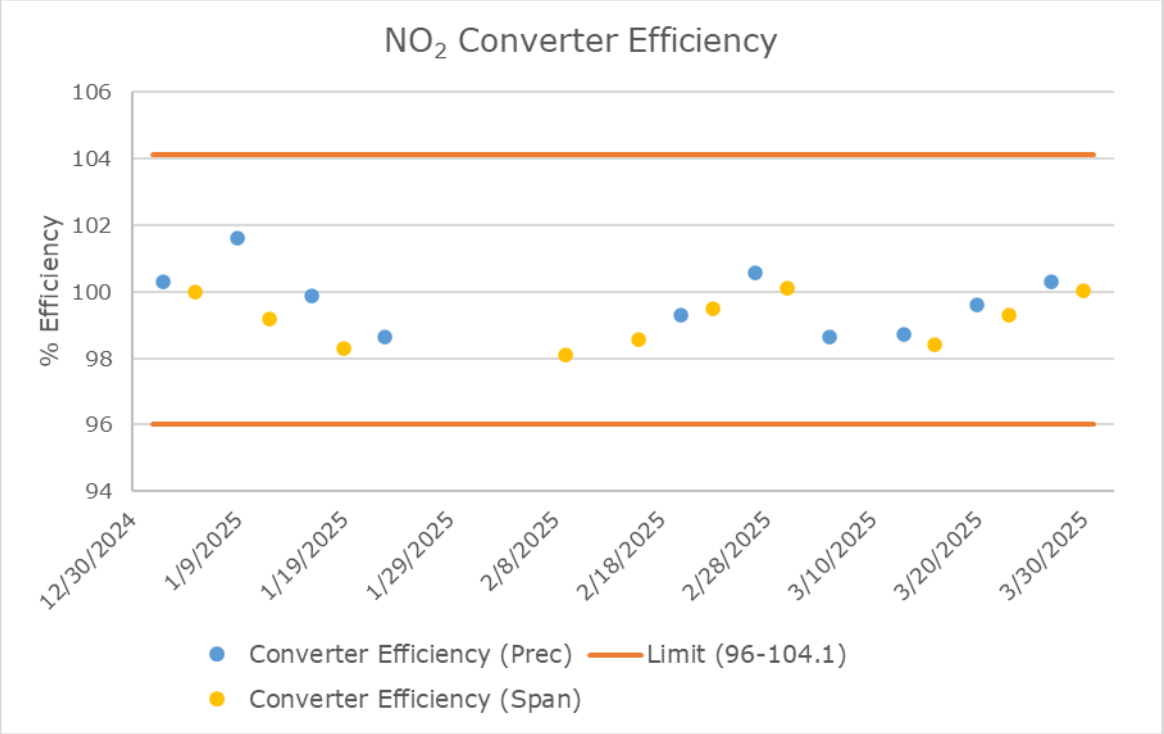

Figure D - 5. 2025 Q1 Converter efficiency for NO_2 at Missile Site Park.

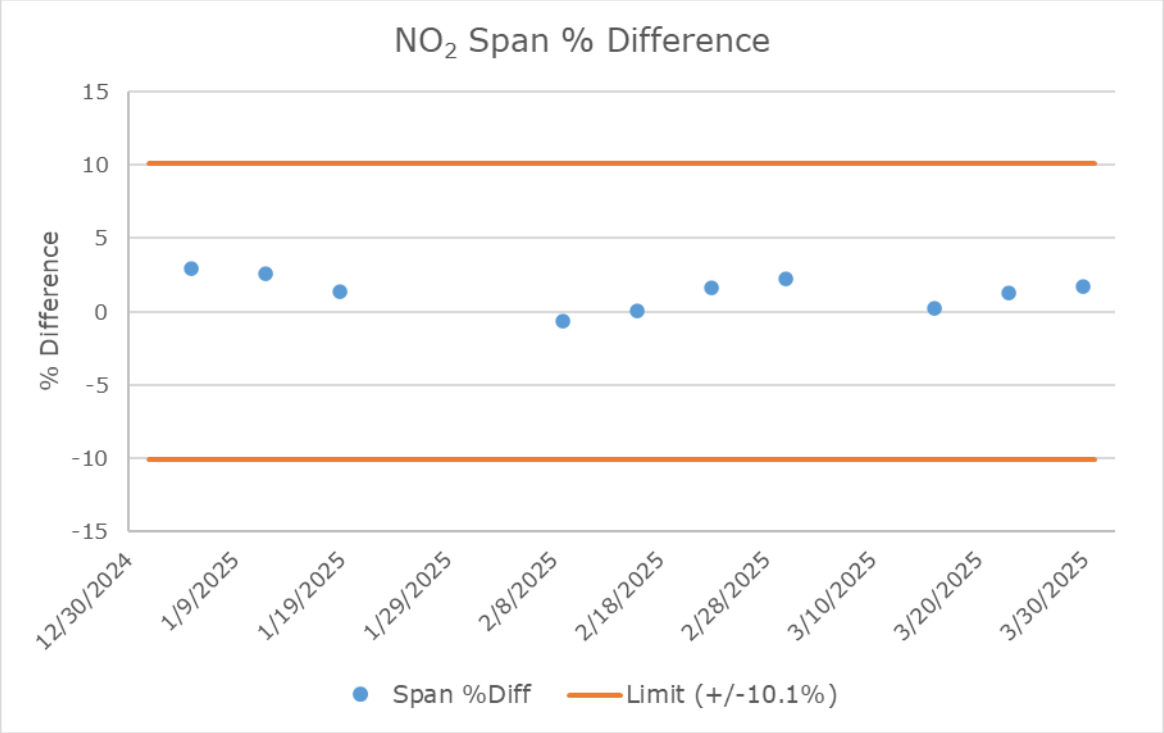

Figure D - 6. 2025 Q1 Calibration span percent difference for NO_2 at Missile Site Park.

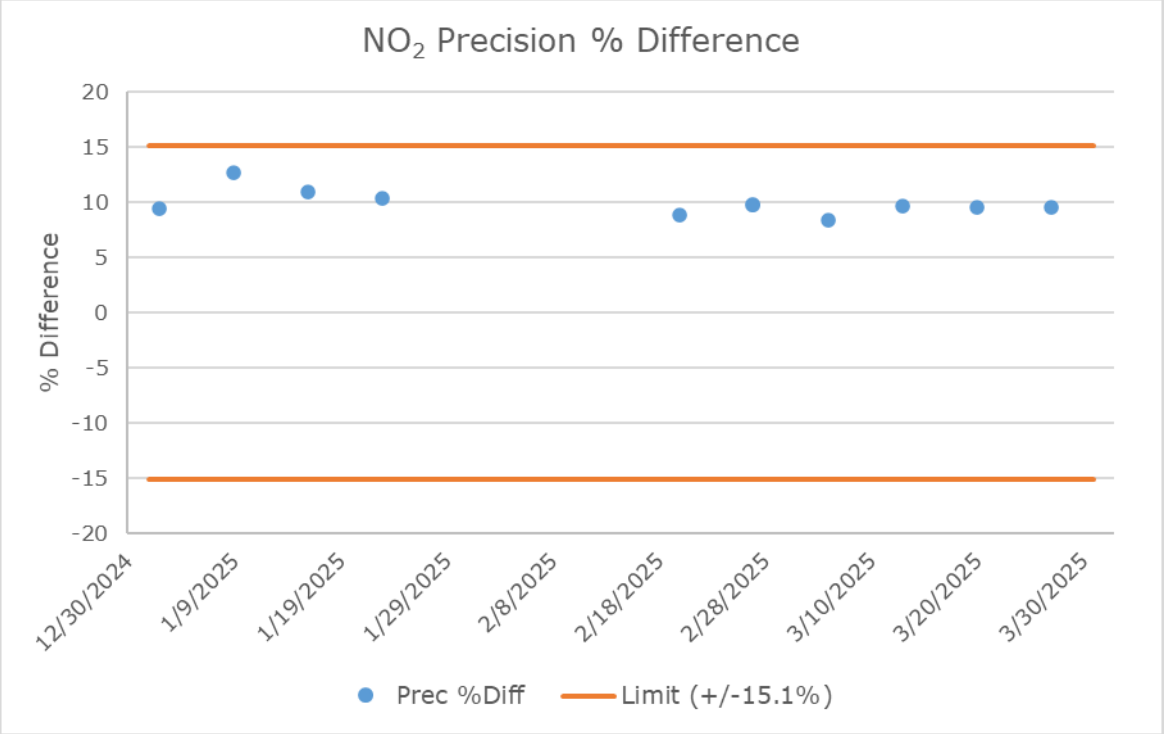

Figure D - 7. 2025 Q1 Calibration precision percent difference for NO_2 at Missile Site Park.

Table D - 3. Summary of 2025 Q1 calibration statistics for NO_2 at Missile Site Park.

Formula	Precision	Span
STDEV	1.19	1.15
Count	10	10
Chi^2, 0.1, n-1	4.17	4.17
CV	1.75	1.69
Bias	10.60	2.02
Bias (+/-/U)	+	+
AB	9.91	1.46
AS	1.19	0.97
$t_{0.95}$, n-1	1.83	1.83
25^{th}	9.45	0.51
75^{th}	10.18	2.09

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. Calibrations on January 28th, February 1st, and February 4th were invalidated due to a shift in analyzer response and are not included. Data is also invalid from January 25th through February 7th and February 12th through February 14th. 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. Note that **Table D - 4** does not include calibration data from periods that were invalidated.

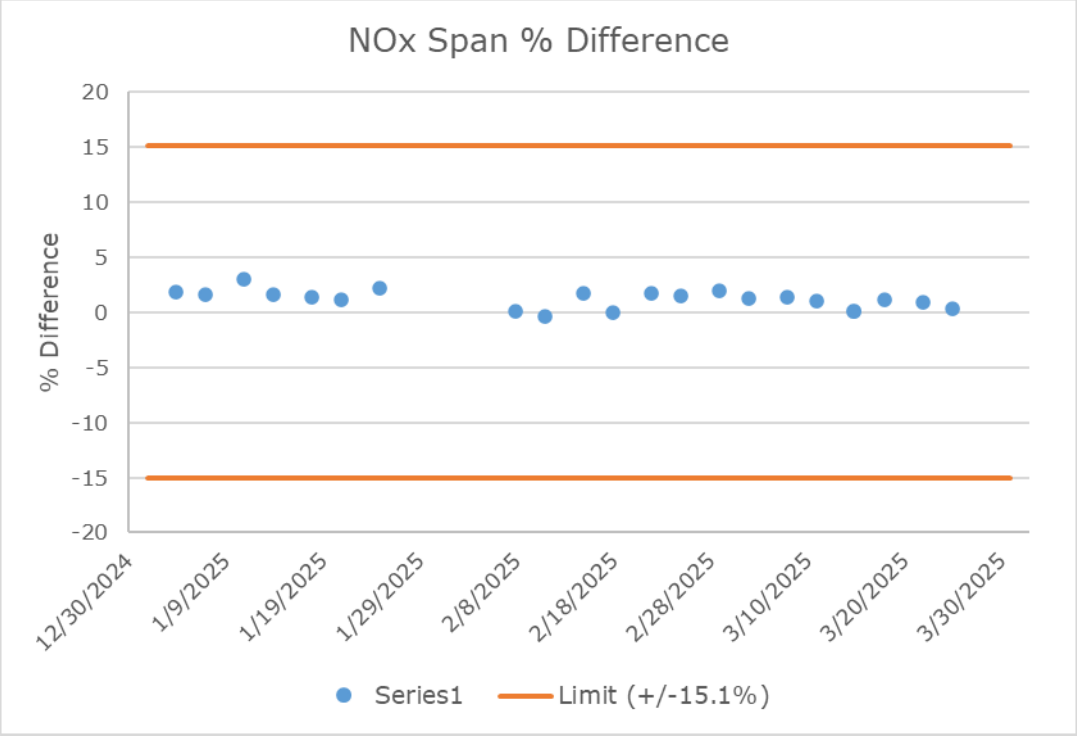

Figure D - 8. 2025 Q1 Calibration span percent difference for NOx at Missile Site Park.

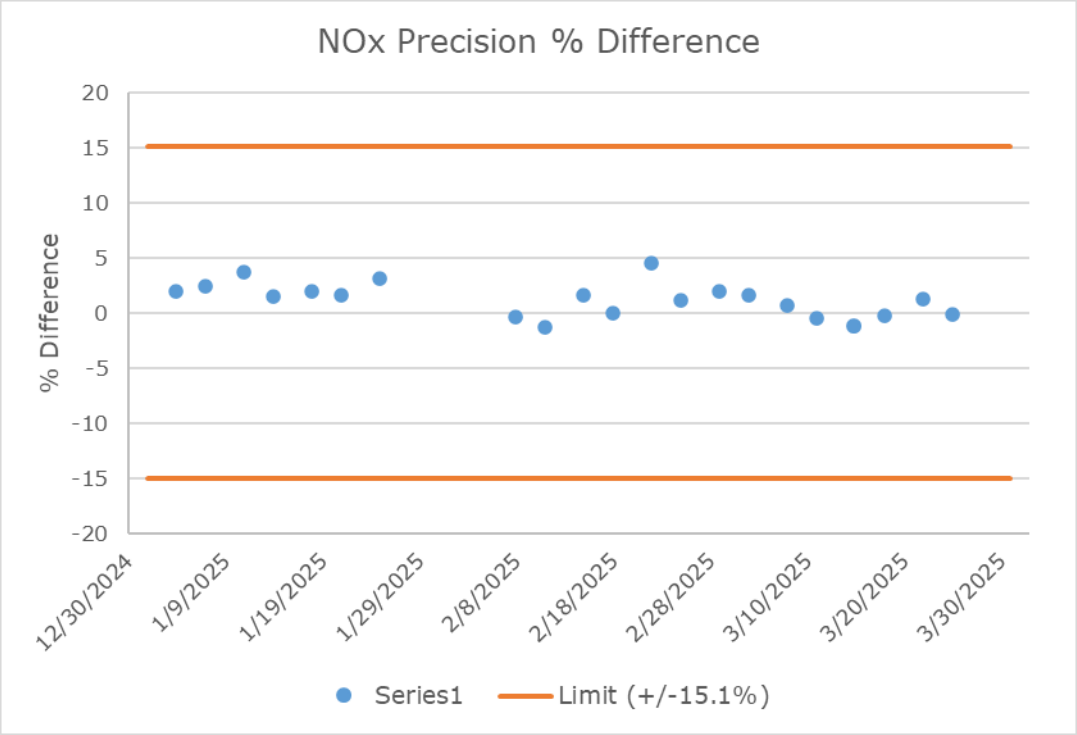

Figure D - 9. 2025 Q1 Calibration precision percent difference for NOx at Missile Site Park.

Table D - 4. Summary of 2025 Q1 calibration statistics for NOx at Missile Site Park.

Formula	Precision	Span
STDEV	1.52	0.81
Count	22	22
Chi^2, 0.1, n-1	13.24	13.24
CV	1.92	1.02
Bias	2.00	1.53
Bias (+/-/U)	U	+
AB	1.58	1.25
AS	1.15	0.76
$t_{0.95}$, n-1	1.72	1.72
25^{th}	-0.09	0.99
75^{th}	1.96	1.71

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. 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. Note that **Table D - 5** does not include calibration data from periods that were invalidated.

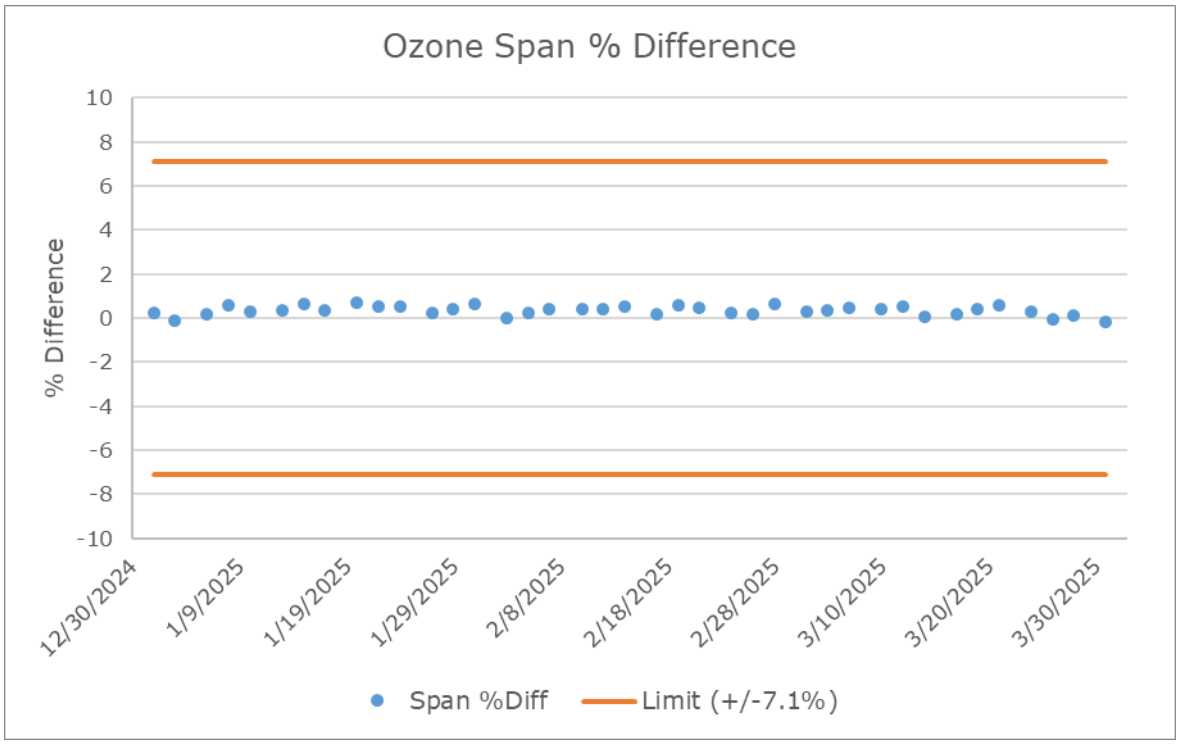

Figure D - 10. 2025 Q1 Calibration span percent difference for O_3 at Hereford.

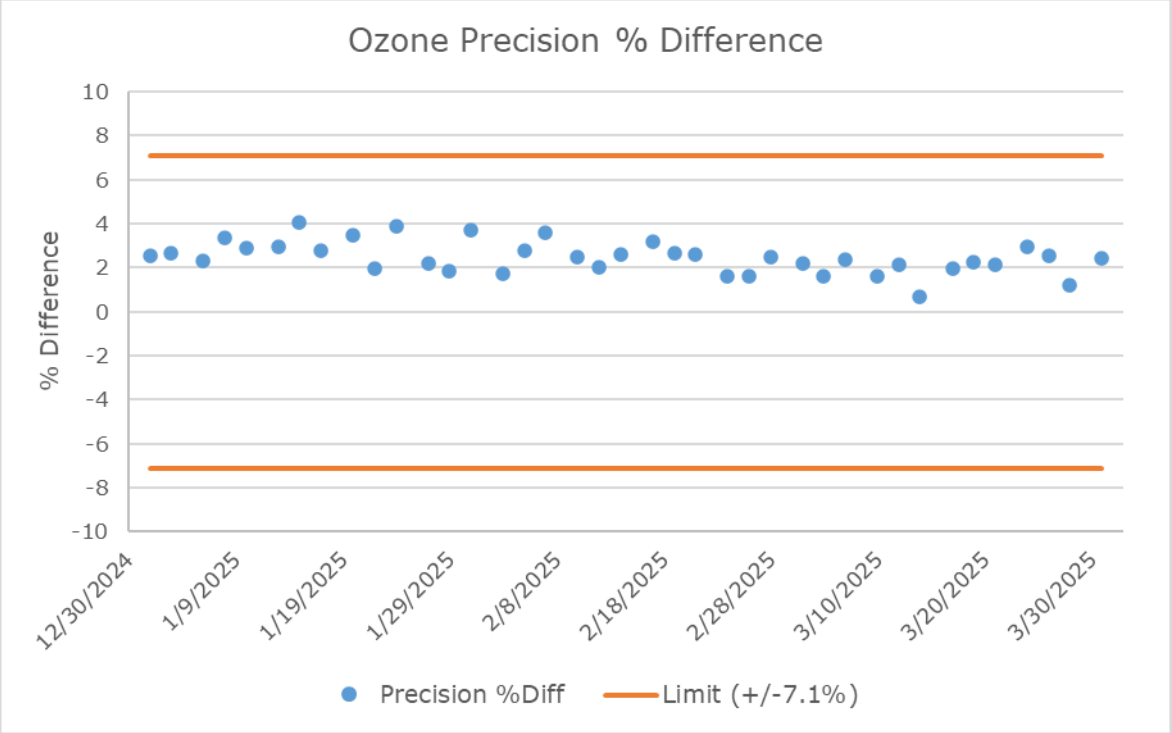

Figure D - 11. 2025 Q1 Calibration precision percent difference for O_3 at Hereford.

Table D - 5. Summary of 2025 Q1 calibration statistics for O_3 at Hereford.

Formula	Precision	Span
STDEV	0.74	0.21
Count	39	39
Chi^2, 0.1, n-1	27.34	27.34
CV	0.87	0.25
Bias	2.66	0.41
Bias (+/-/U)	+	+
AB	2.46	0.36
AS	0.74	0.18
$t_{0.95}$, n-1	1.69	1.69
25^{th}	1.99	0.21
75^{th}	2.84	0.51

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. 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.

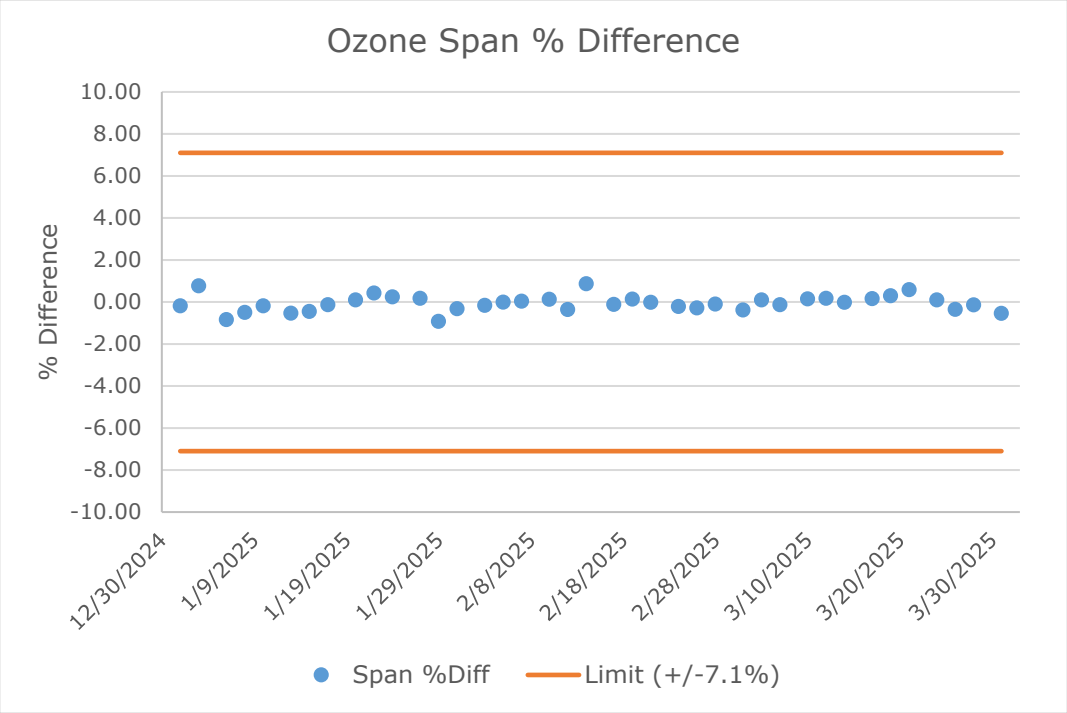

Figure D - 12. 2025 Q1 Calibration span percent difference for O_3 at Orchard.

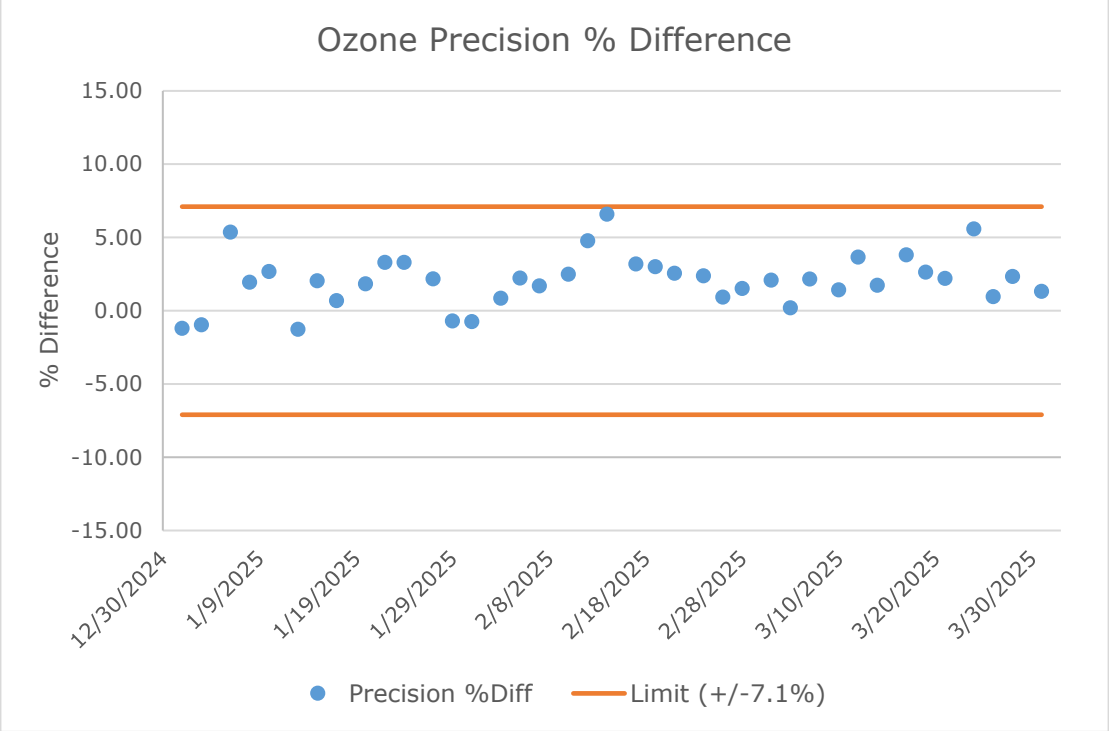

Figure D - 13. 2025 Q1 Calibration precision percent difference for O_3 at Orchard.

Table D - 6. Summary of 2025 Q1 calibration statistics for O_3 at Orchard.

Formula	Precision	Span
STDEV	1.78	0.38
Count	39	39
Chi^2, 0.1, n-1	27.34	27.34
CV	2.10	0.44
Bias	2.70	0.36
Bias (+/-/U)	+	U
AB	2.32	0.29
AS	1.43	0.25
$t_{0.95}$, n-1	1.69	1.69
25^{th}	1.13	-0.30
75^{th}	2.84	0.14