CR-02-02-01
R0019

BERMUDA ELECTRIC LIGHT COMPANY, LTD.

ANNUAL AMBIENT AIR QUALITY MONITORING REPORT

FOR THE PERIOD

JANUARY 1ST TO DECEMBER 31ST, 2023

MARCH 1ST, 2024

PREPARED BY: OHSE Coordinator

Table of Contents

List of Tables

List of Figures

Introduction

This report summarizes the findings and operation of BELCO's Ambient Air Quality Monitoring for the period January 1st to December 31st, 2023, as required by Condition 6.3.1 and 6.3.4 of BELCO's Operating License, #OL-114.

BELCO operates and maintains four ambient air quality monitoring stations. 'BDA1' is located on Cemetery Lane, Pembroke, and measures both pollutant and meteorological parameters. 'BDA2' is located on Langton Crescent, Pembroke, and measures pollutant parameters. 'BDA3' is located in the northwest corner of BELCO's Pembroke Power Station and measures meteorological parameters. 'BDA4' did not operate throughout 2023 and is currently stored at BELCO's Pembroke Power Station.

Exceedance Report

During the reporting period, zero (0) exceedances of the Bermuda Ambient Air Quality Standards (BAAQS) were recorded at BELCO's ambient air quality monitoring stations, 'BDA1'and 'BDA2'; please refer to Table 1 and Table 2 for details. Annual averages of all measured pollutant parameters were below the annual BAAQS at both 'BDA1'and 'BDA2', stations in 2023.

Table 1: BAAQS exceedance record for the reporting period.

Station	Parameter	BAAQS - 1-Hr (µg/m³)	Max. 1-Hr Avg. (µg/m³)	# of Exceed. (1-hr)	BAAQS - 24-Hr (µg/m³)	Max. 24-hr Avg. (µg/m³)	# of Exceed. (24-Hr)	BAAQS – Annual (µg/m³)	Annual Avg. (µg/m³)	# of Exceed. (Annual)
BDA1	NO_2	400	61	0	200	23	0	60	3.6	0
	SO_2	450	39	0	150	8	0	30	2.3	0
	PM_{10}	-	-	-	50	30	0	30	12.3	0
BDA2	NO_2	400	98	0	200	49	0	60	6.1	0
	SO_2	450	214	0	150	88	0	30	5.7	0
	PM_{10}	-	-	-	50	37	0	30	12.7	0
Total Number of BAAQS Exceedances Recorded During Reporting Period										**0**

Table 2: BAAQS exceedance log for the reporting period.

Station	Parameter	Averaging Period	Date/Time (AST)	Concentration (ug/m3)	BAAQS (ug/m3)
-	-	-	-	-	-

Annual Data

All valid data collected during the reporting period is provided in tabular form in the excel spreadsheet titled "BELCO AQMS Dataset – 2023 Annual", which has been provided electronically with this report.

Data Availability

An annual summary of data availability figures for 2023 is provided in Table 3 and illustrated in Figures 1-4.

Data collection at all sites was interrupted for periods of time throughout 2023 in order to perform routine maintenance, recalibrate instrumentation, audit instrumentation, lower the meteorological tower in high winds, and to troubleshoot and resolve instrument failures. Detailed explanations of significant periods of downtime (>6 hours) can be found in the quarterly reports submitted throughout 2023.

Table 3: Annual summary of data availability figures for BDA1, BDA2, and BDA3.

	Q1	Q2	Q3	Q4	2023 Annual	Target
BDA1 - Pollutant Parameters						
NO_2	93.1%	96.6%	96.6%	98.7%	96.3%	75.0%
SO_2	93.0%	85.4%	28.9%	98.5%	76.5%	75.0%
PM_{10}	76.7%	62.4%	91.2%	88.8%	79.8%	75.0%
BDA1 - Meteorological Parameters						
Wind Direction	100.0%	98.9%	99.7%	99.7%	99.6%	90.0%
Horiz. Wind Speed	100.0%	98.9%	99.7%	99.7%	99.6%	90.0%
Vert. Wind Speed	100.0%	98.9%	99.7%	99.7%	99.6%	90.0%

Temperature	99.9%	99.9%	99.9%	99.9%	99.9%	90.0%
Rel. Humidity	99.9%	99.9%	99.9%	99.9%	99.9%	90.0%
BDA2 - Pollutant Parameters						
NO_2	97.0%	98.4%	98.8%	99.0%	98.3%	75.0%
SO_2	95.7%	98.8%	96.3%	98.9%	97.4%	75.0%
PM_{10}	43.9%	82.7%	65.8%	88.0%	70.1%	75.0%
BDA3 - Meteorological Parameters (SODAR, 65m)						
Wind Direction	67.4%	69.3%	75.8%	66.7%	69.8%	90.0%
Horiz. Wind Speed	67.5%	69.3%	75.8%	66.7%	69.8%	90.0%
Vert. Wind Speed	84.0%	80.0%	84.8%	73.9%	80.7%	90.0%

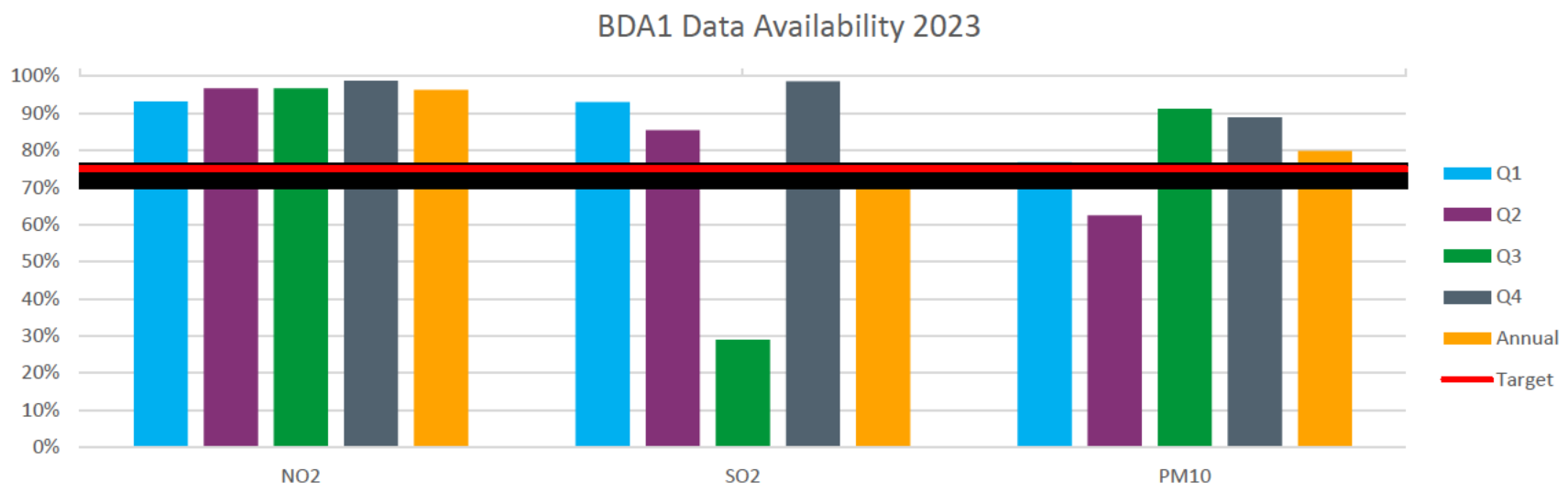

Fig. 1: Data Availability Rates for BDA1 monitoring station, pollutant parameters.

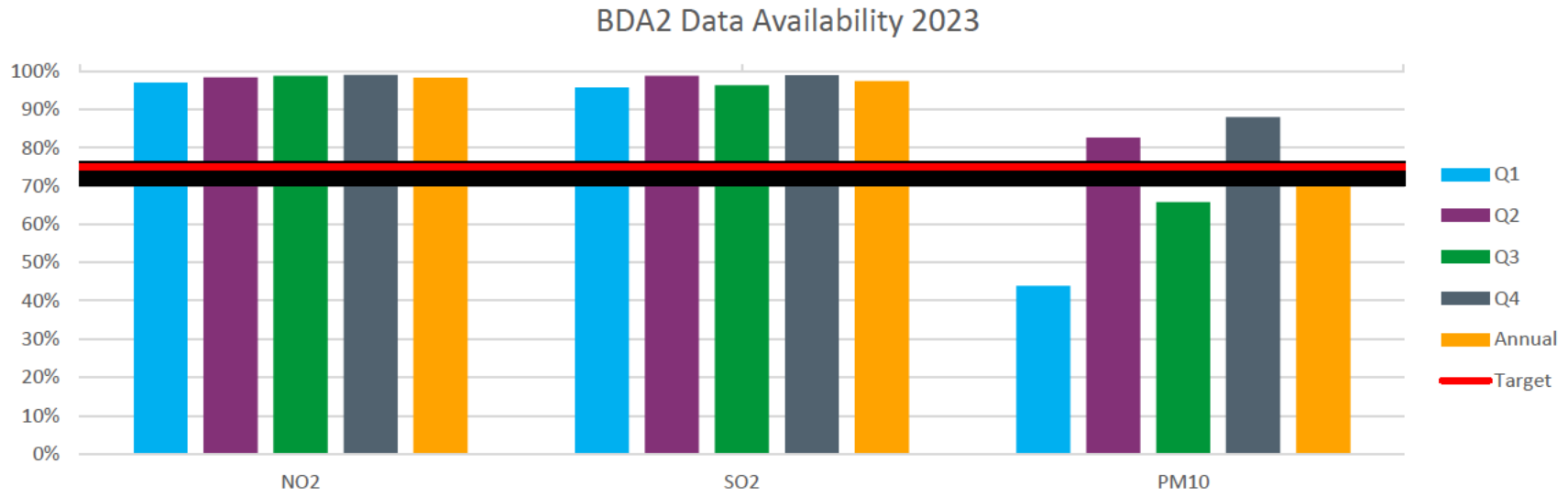

Fig. 2: Data Availability Rates for BDA2 monitoring station, pollutant parameters.

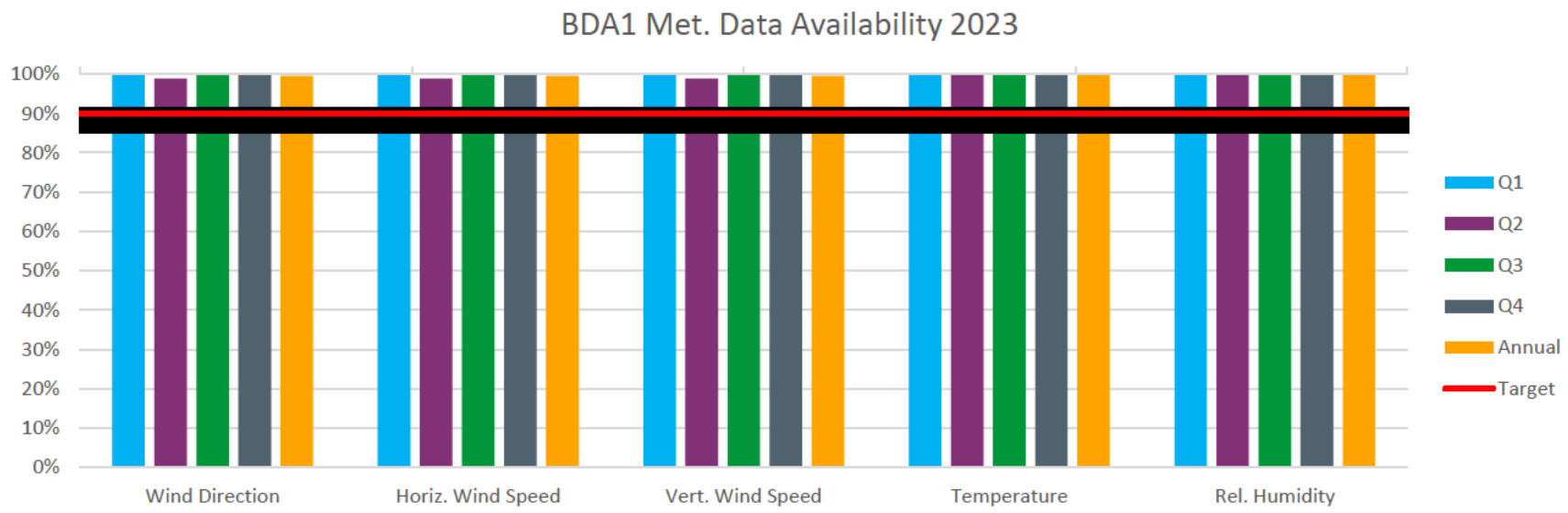

Fig. 3: Data Availability Rates for BDA1 monitoring station, meteorological parameters.

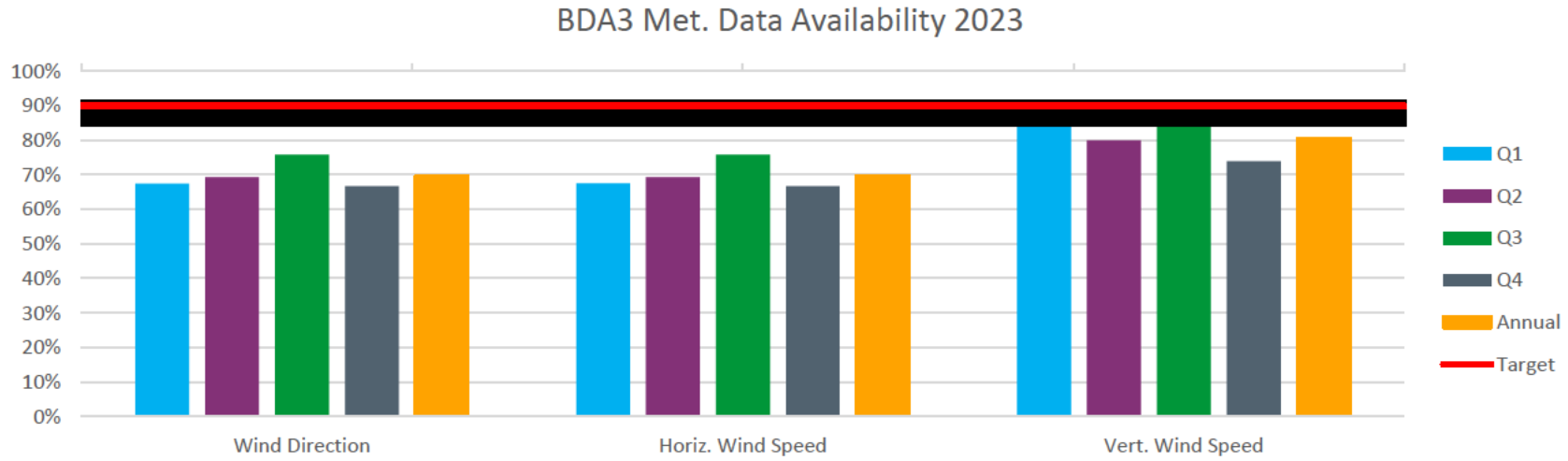

Fig. 4: Data Availability Rates for BDA3 monitoring station, meteorological parameters.

Year-on-Year Comparison of Average & Maximum Recorded Pollutant Concentrations

Year-on-year comparisons of maximum 1-hr average concentrations of SO_2 and NO_2, maximum 24-hr average concentrations of SO_2, NO_2, and PM_{10}, as well as annual averages of SO_2, NO_2, and PM_{10} recorded at BELCO's 'BDA1', 'and BDA2'monitoring stations during the years 2006-2023 are illustrated in Figures 5-12. Year-on-year illustrations of data collected from the 'BDA4'monitoring station may not be representative of the values recorded over a full calendar year as data collected in 2020 was limited to the months of October-December with operations suspended in June 2022.

With regards to trends observed in Nitrogen Dioxide (NO_2) concentrations recorded:

- Max. 1-hr avg. concentrations of NO_2 are trending downward at 'BDA1'; trending downward at 'BDA2'.
- Max 24-hr avg. concentrations of NO_2 are trending as stable at 'BDA1'; trending upward at 'BDA2'.
- Annual avg. concentrations of NO_2 are trending stable at 'BDA1'; trending upward at 'BDA2'.

With regards to trends observed in Sulphur Dioxide (SO_2) concentrations recorded:

- Max. 1-hr avg. concentrations of SO_2 are trending as relatively stable at 'BDA1'; trending relatively stable at 'BDA2'.
- Max 24-hr avg. concentrations of SO_2 are trending as stable at 'BDA1'; trending upward at 'BDA2'.
- Annual avg. concentrations of SO_2 are trending as stable at 'BDA1'; trending upward at 'BDA2'.

With regards to trends observed in Particulate Matter <10 microns in diameter (PM_{10}) concentrations recorded:

- Max 24-hr avg. concentrations of PM_{10} are trending downward at 'BDA1'; trending upward at 'BDA2'.
- Annual avg. concentrations of PM_{10} are trending downward at 'BDA1'; trending upward at 'BDA2'.

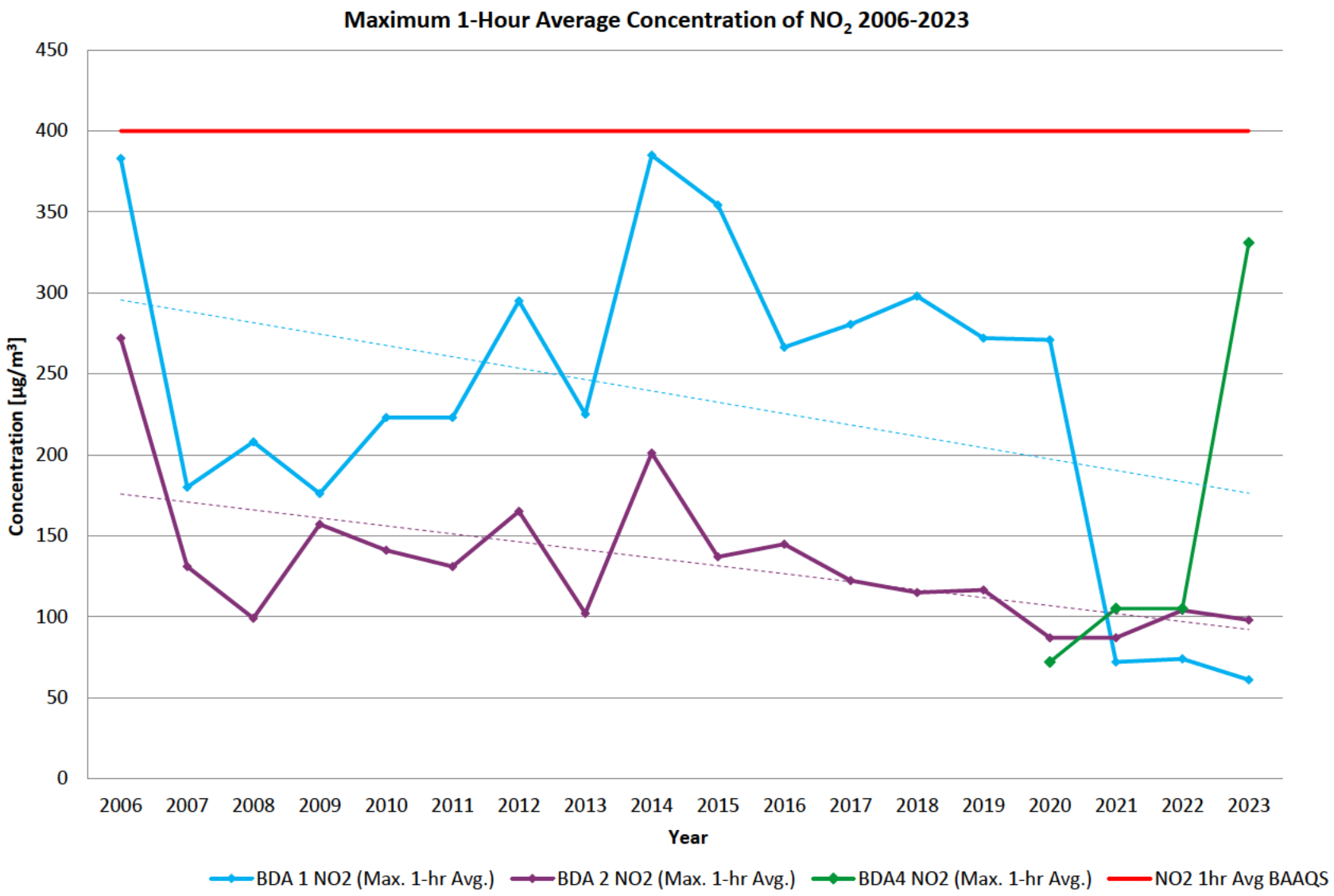

Fig. 5: Maximum 1-Hour Average Concentration of NO_2 Recorded at BDA1, BDA2, and BDA4 Monitoring Stations 2006-2023

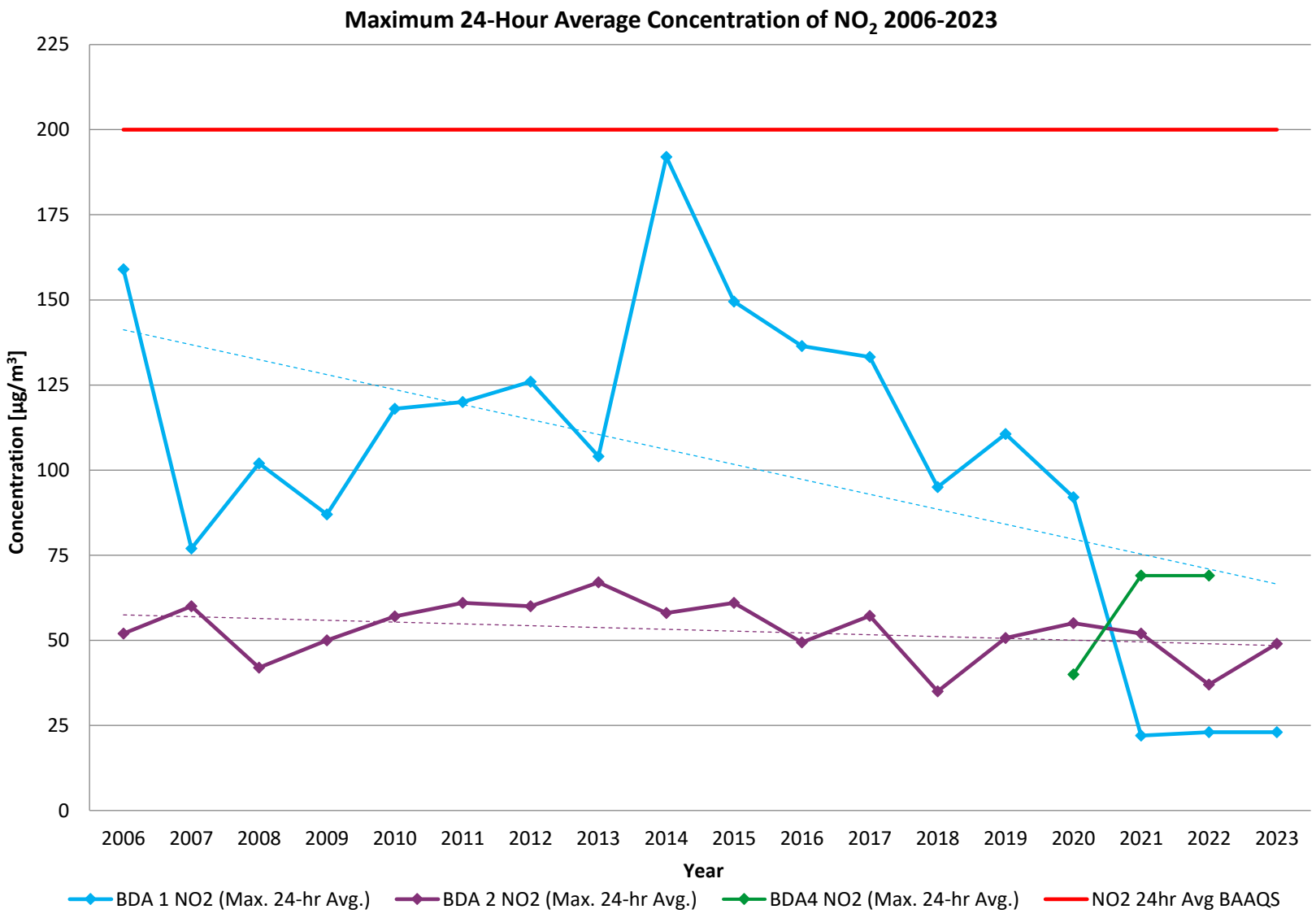

Fig. 6: Maximum 24-Hour Average Concentration of NO_2 Recorded at BDA1, BDA2, and BDA4 Monitoring Stations 2006-2023

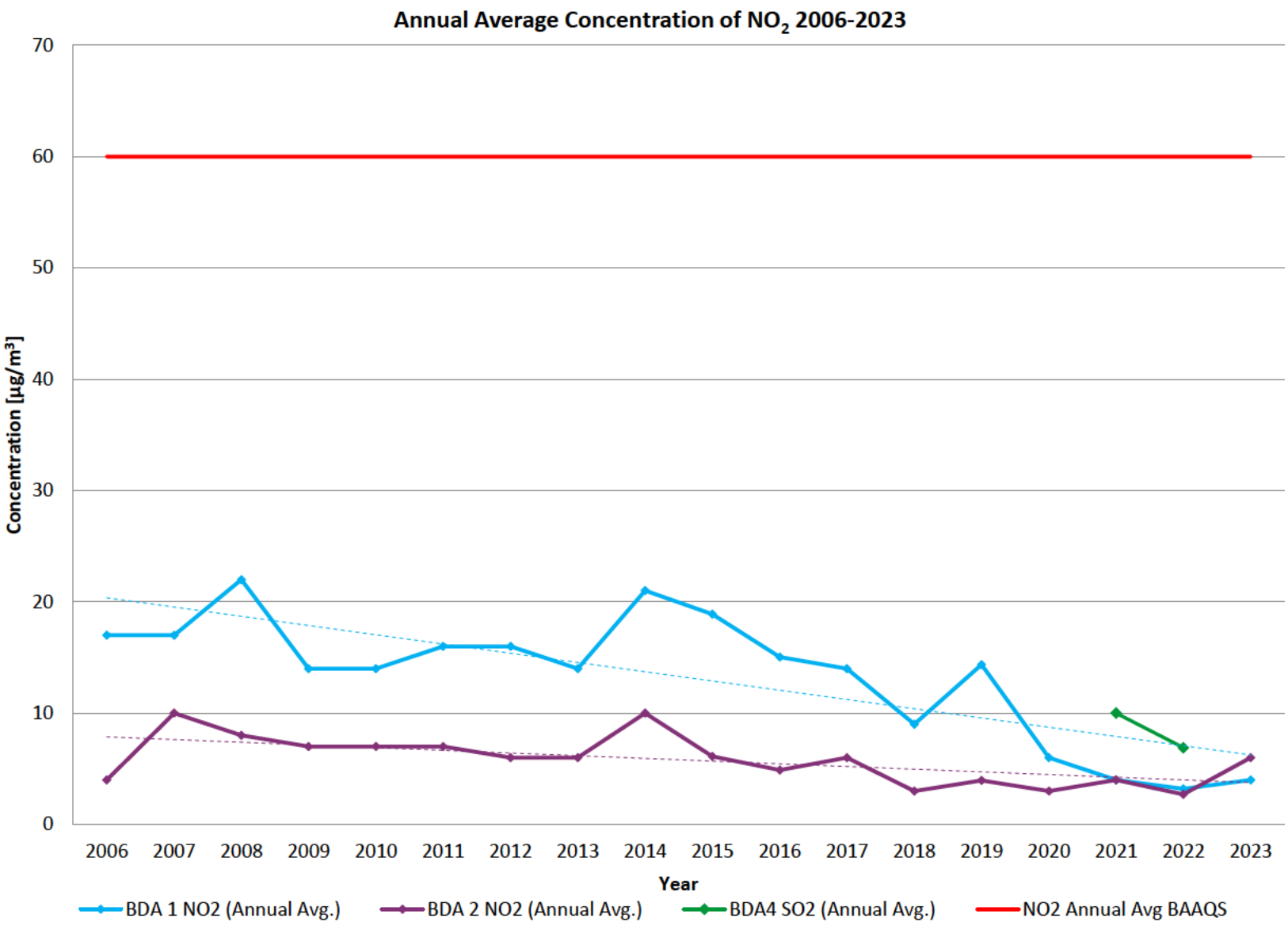

Fig 7: Annual Average Concentration of NO_2 Recorded at BDA1, BDA2, and BDA4 Monitoring Stations 2006-2023

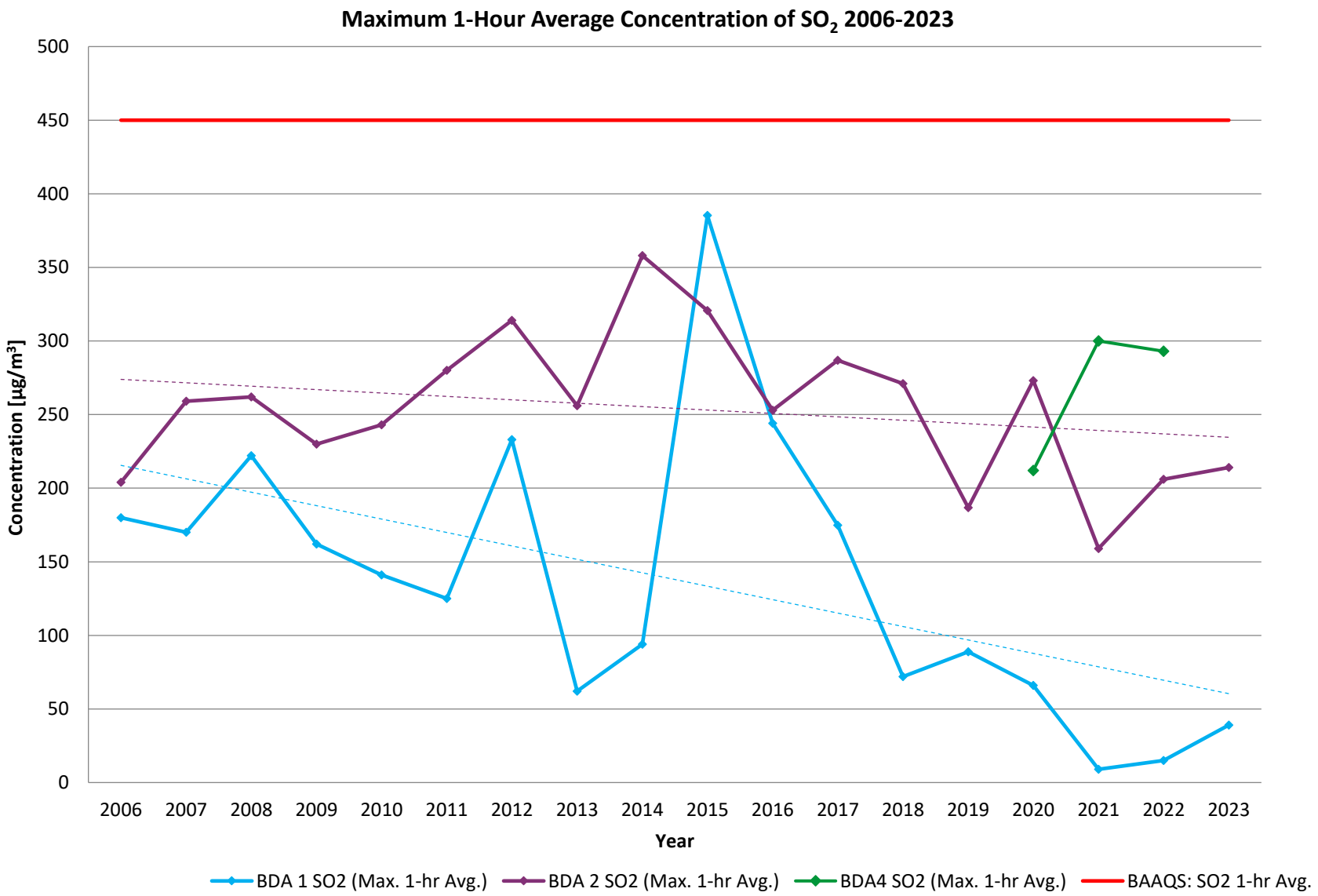

Fig 8: Maximum 1-Hour Average Concentration of SO_2 Recorded at BDA1, BDA2, and BDA4 Monitoring Stations 2006-2023

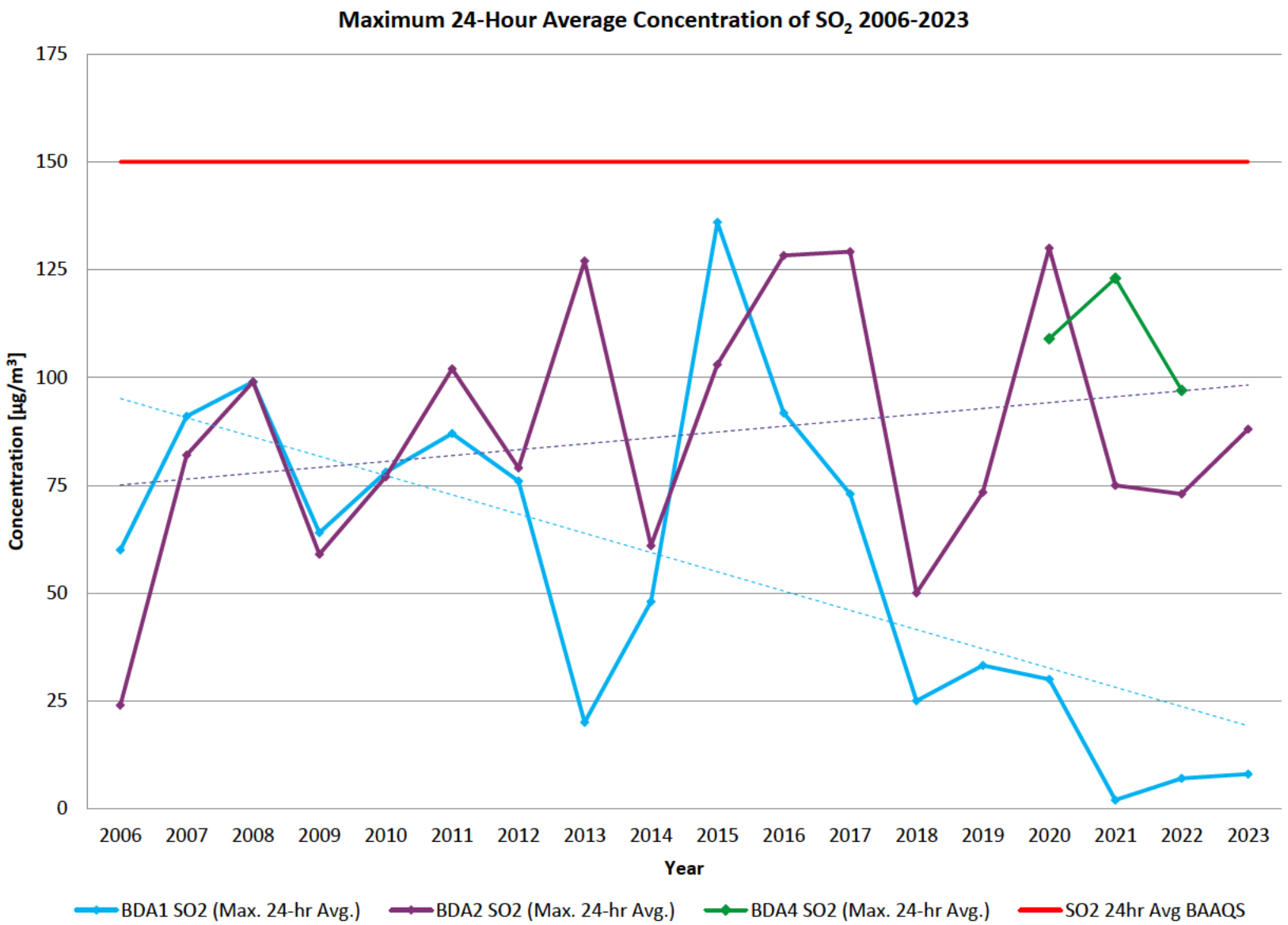

Fig. 9: Maximum 24-Hour Average Concentration of SO_2 Recorded at BDA1, BDA2, and BDA4 Monitoring Stations 2006-2023

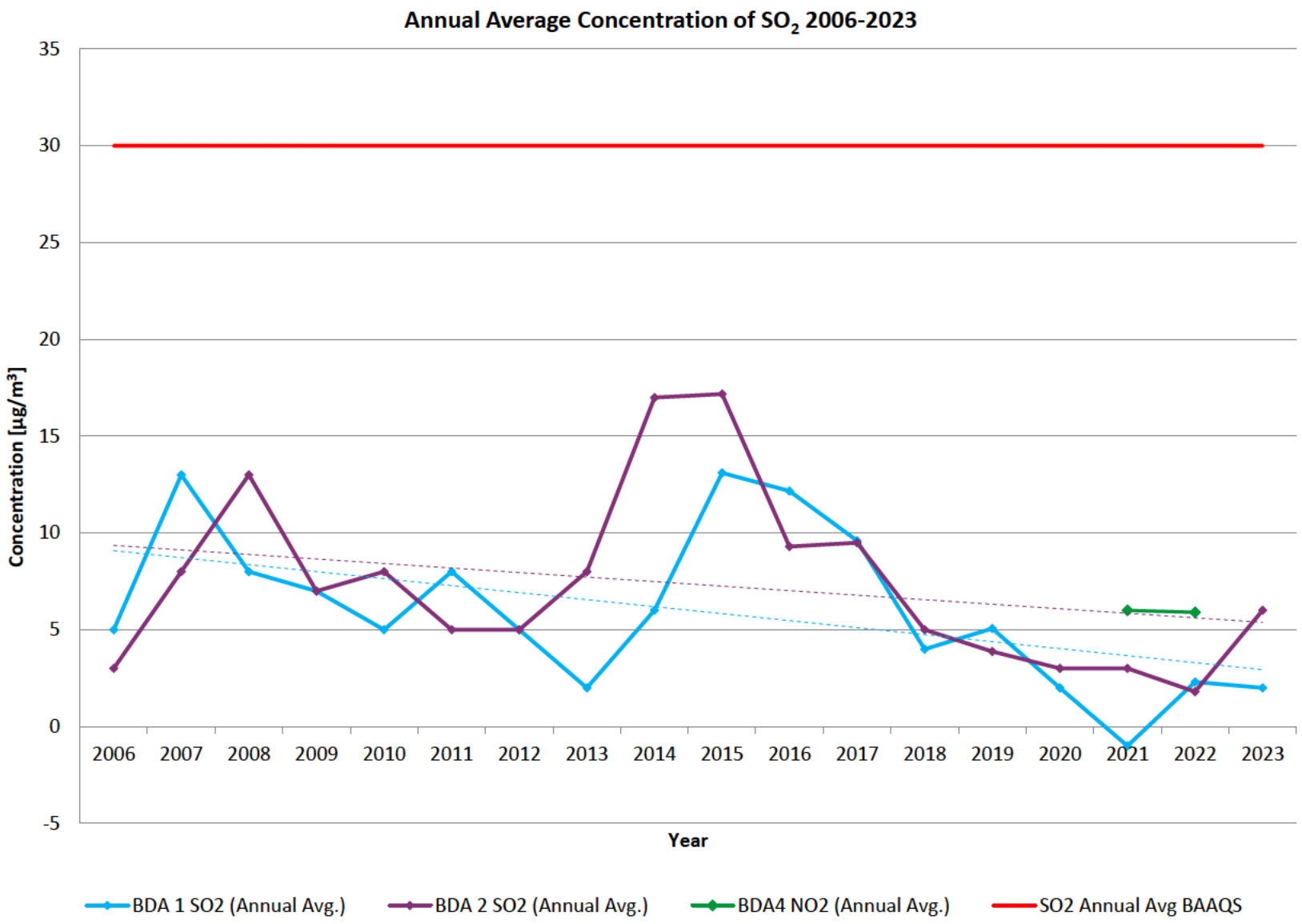

Fig. 10: Annual Average Concentration of SO_2 Recorded at BDA1, BDA2, and BDA4 Monitoring Stations 2006-2023

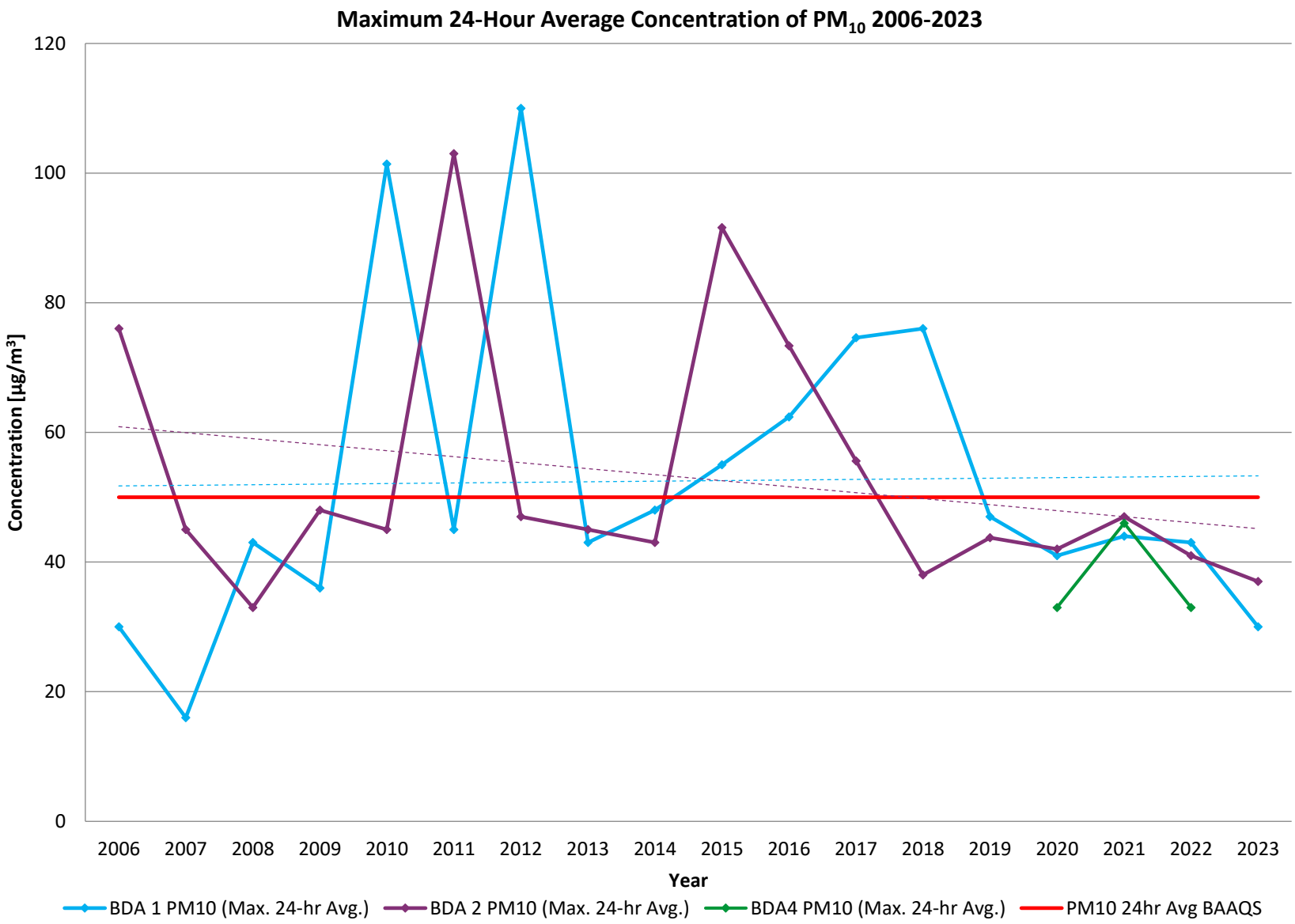

Fig. 11: Maximum 24-Hour Average Concentration of PM_{10} Recorded at BDA1, BDA2, and BDA4 Monitoring Stations 2006-2023

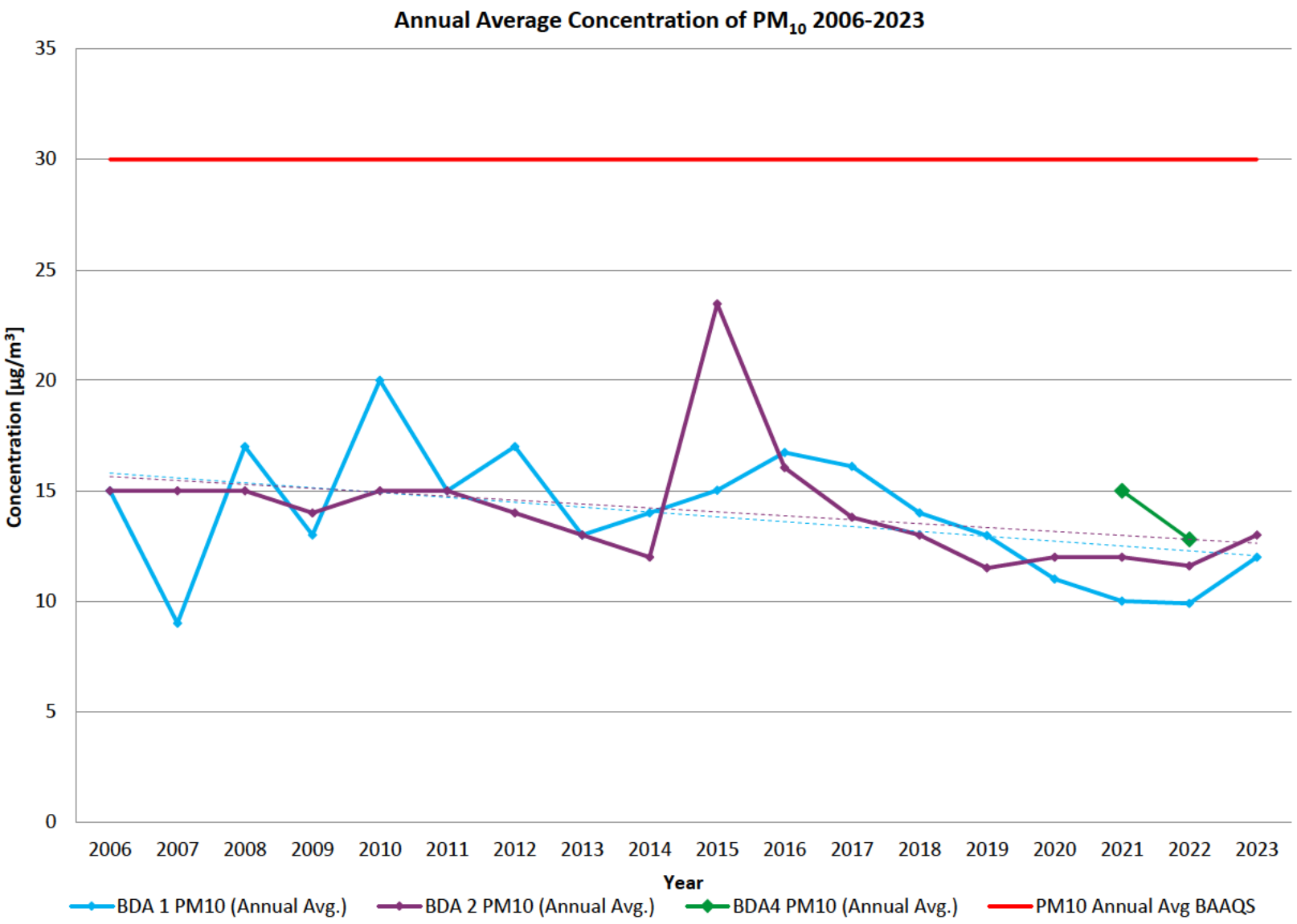

Fig. 12: Annual Average Concentration of PM_{10} Recorded at BDA1, BDA2, and BDA4 Monitoring Stations 2006-2023

Semiannual Audits

BELCO's Air Quality Monitoring System (AQMS) was audited in June and December of 2023 by an independent auditor, Environmental Engineering & Measurement Services, Inc., as per condition 5.4.7 of BELCO's Operating License Conditions. Full copies of the audit reports are provided in **Appendix A**.

Conclusion

Zero (0) exceedances of the Bermuda Ambient Air Quality Standards (BAAQS) were recorded during this reporting period. Annual average concentrations of all gaseous and particulate parameters were measured to be below BAAQS. All monitoring equipment was routinely maintained and calibrated throughout the year. Independent audits of BELCO's air quality monitoring program were completed in June and December of 2023.