CR-02-01-01
R0036

BERMUDA ELECTRIC LIGHT COMPANY, LTD.

ANNUAL AMBIENT AIR QUALITY MONITORING REPORT

FOR THE PERIOD

JANUARY 1ST TO DECEMBER 31ST, 2020

MARCH 1ST, 2021

PREPARED BY: OHSE COORDINATOR

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Introduction

This report summarizes the findings and operation of BELCO's Ambient Air Quality Monitoring for the period January 1st to December 31st, 2020, as required by Condition 6.3.1 and 6.3.4 of BELCO's Operating License, #OL-114.

BELCO operates and maintains three 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.

Exceedance Report

During the reporting period, zero (0) exceedances of the Bermuda Ambient Air Quality Standards (BAAQS) were recorded at BELCO's two 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 2020.

Table 1: BAAQS exceedance record for the reporting period.

Station	Parameter	BAAQS - 1-Hr ($\mu g/m^3$)	Max. 1-Hr Avg. ($\mu g/m^3$)	# of Exceed. (1-hr)	BAAQS - 24-Hr ($\mu g/m^3$)	Max. 24-hr Avg. ($\mu g/m^3$)	# of Exceed. (24-Hr)	BAAQS – Annual ($\mu g/m^3$)	Annual Avg. ($\mu g/m^3$)	# of Exceed. (Annual)
BDA1	**NO_2**	**400**	271	0	**200**	92	0	**60**	6	0
	SO_2	**450**	66	0	**150**	30	0	**30**	2	0
	PM_{10}	**-**	-	-	**50**	41	0	**30**	11	0
	TSP	**-**	-	-	**100**	28	0	**60**	16	0
BDA2	**NO_2**	**400**	87	0	**200**	55	0	**60**	3	0
	SO_2	**450**	273	0	**150**	130	0	**30**	3	0
	PM_{10}	**-**	-	-	**50**	42	0	**30**	12	0
	TSP	**-**	-	-	**100**	30	0	**60**	17	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 – 2020 Annual", which has been provided electronically with this report.

Data Availability

An annual summary of data availability figures for 2020 is provided in Table 3 and illustrated in Figures 1-3.

Data collection at all sites was interrupted for periods of time throughout 2020 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 2020.

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

	Q1	Q2	Q3	Q4	2020 Annual	Target
BDA1 - Pollutant Parameters						
NO_2	93.4%	93.4%	79.6%	85.3%	88.1%	75.0%
SO_2	97.9%	97.9%	93.6%	97.1%	96.1%	75.0%
PM_{10}	98.7%	98.7%	92.9%	98.5%	96.7%	75.0%
BDA1 - Meteorological Parameters						
Wind Direction	100.0%	98.3%	87.7%	93.6%	94.9%	90.0%
Horiz. Wind Speed	100.0%	98.3%	87.7%	93.6%	94.9%	90.0%
Vert. Wind Speed	100.0%	98.3%	87.7%	93.6%	94.9%	90.0%
Temperature	100.0%	98.3%	92.2%	93.6%	96.0%	90.0%
Rel. Humidity	100.0%	98.3%	92.2%	93.6%	96.0%	90.0%

BDA2 - Pollutant Parameters						
NO_2	97.4%	97.4%	77.7%	84.2%	88.5%	75.0%
SO_2	97.5%	97.5%	90.1%	96.4%	95.1%	75.0%
PM_{10}	95.9%	95.9%	87.6%	99.0%	95.3%	75.0%
BDA3 - Meteorological Parameters						
SODAR	81.4%	85.1%	68.0%	52.6%	71.8%	90.0%

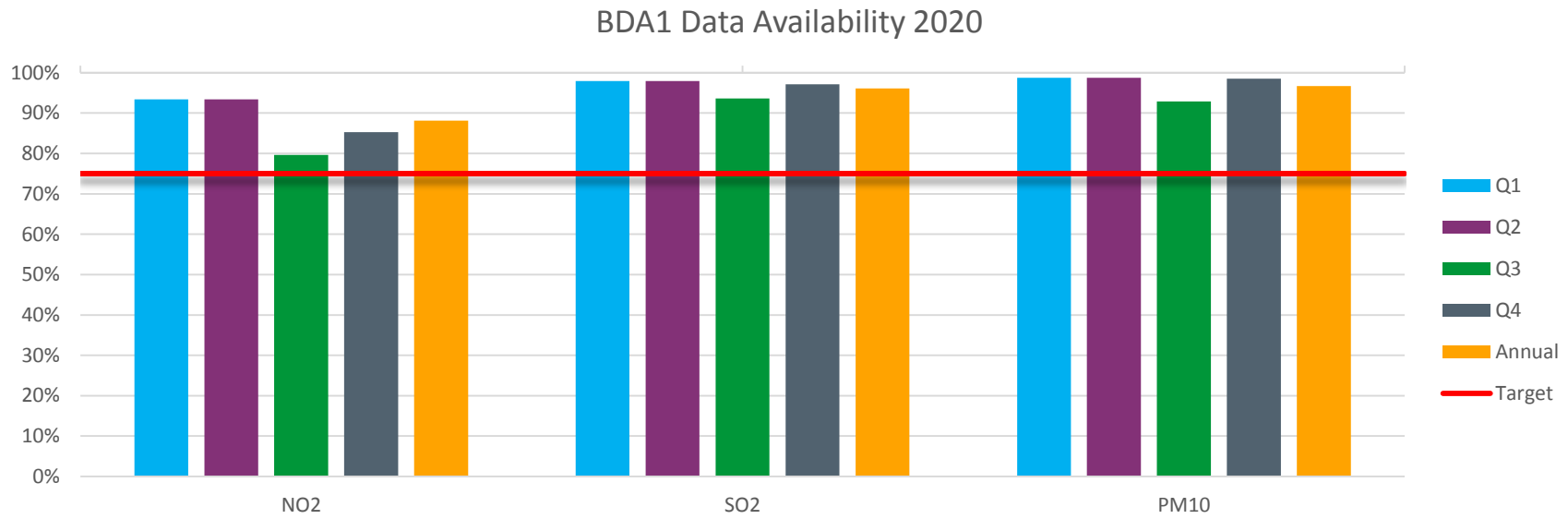

Fig. 1: Data Availability Rates for BDA1 monitoring station, pollutant parameters.

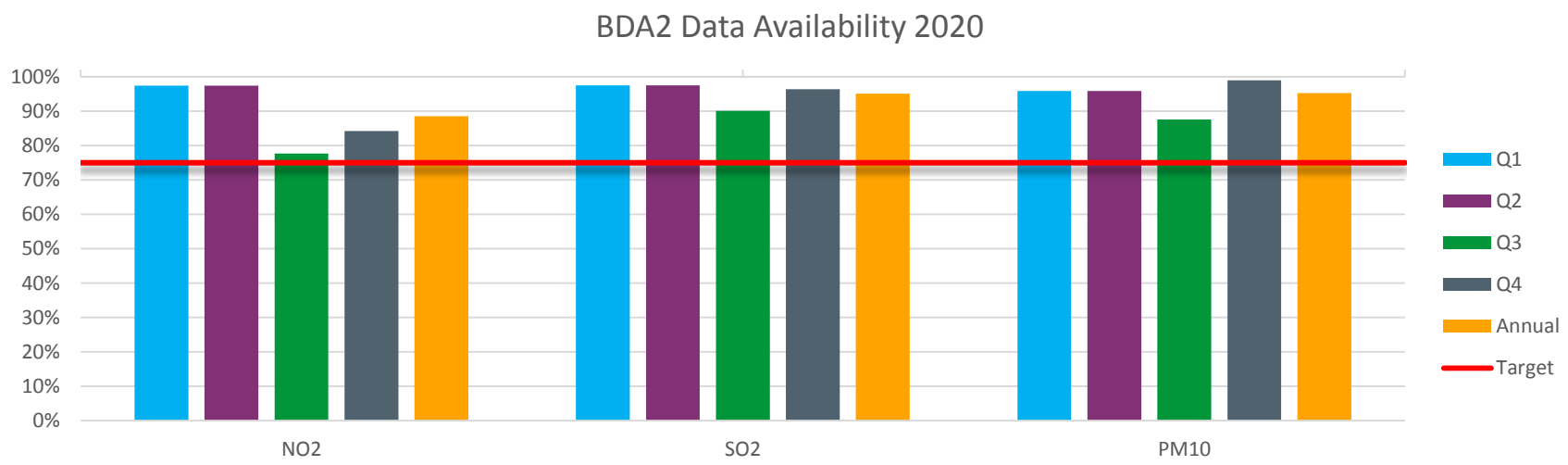

Fig. 2: Data Availability Rates for BDA2 monitoring station, pollutant parameters.

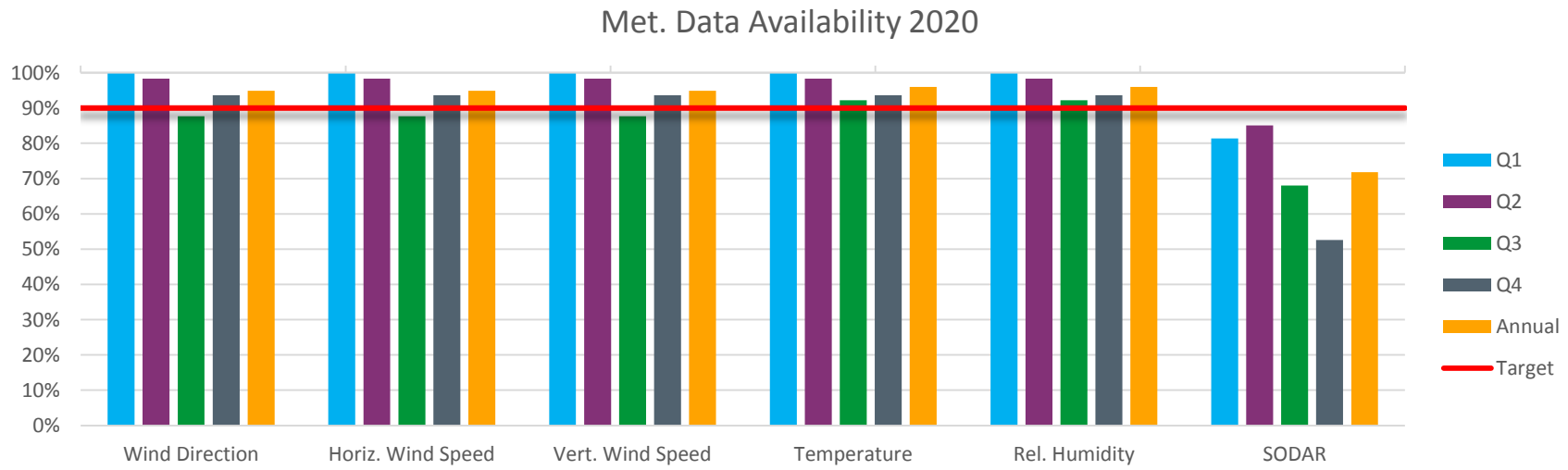

Fig. 3: Data Availability Rates for BDA1 and BDA3 monitoring station, meteorological parameters.

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, PM_{10}, and TSP, as well as annual averages of SO_2, NO_2, PM_{10}, and TSP recorded at BELCO's 'BDA1' and 'BDA2' monitoring stations during the years 2006-2020 are illustrated in Figures 2-11.

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

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

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

- Max. 1-hr avg. concentrations of SO_2 are trending downward at 'BDA1'; trending upward at 'BDA2'.
- Max 24-hr avg. concentrations of SO_2 are trending downward at 'BDA1'; trending upward at 'BDA2'.
- Annual avg. concentrations of SO_2 are trending downward at 'BDA1'; trending stable 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 upward at 'BDA1'; trending downward at 'BDA2'.
- Annual avg. concentrations of PM_{10} are trending downward at 'BDA1'; trending downward at 'BDA2'.

With regards to trends observed in Total Suspended Particulate Matter (TSP) concentrations recorded:

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

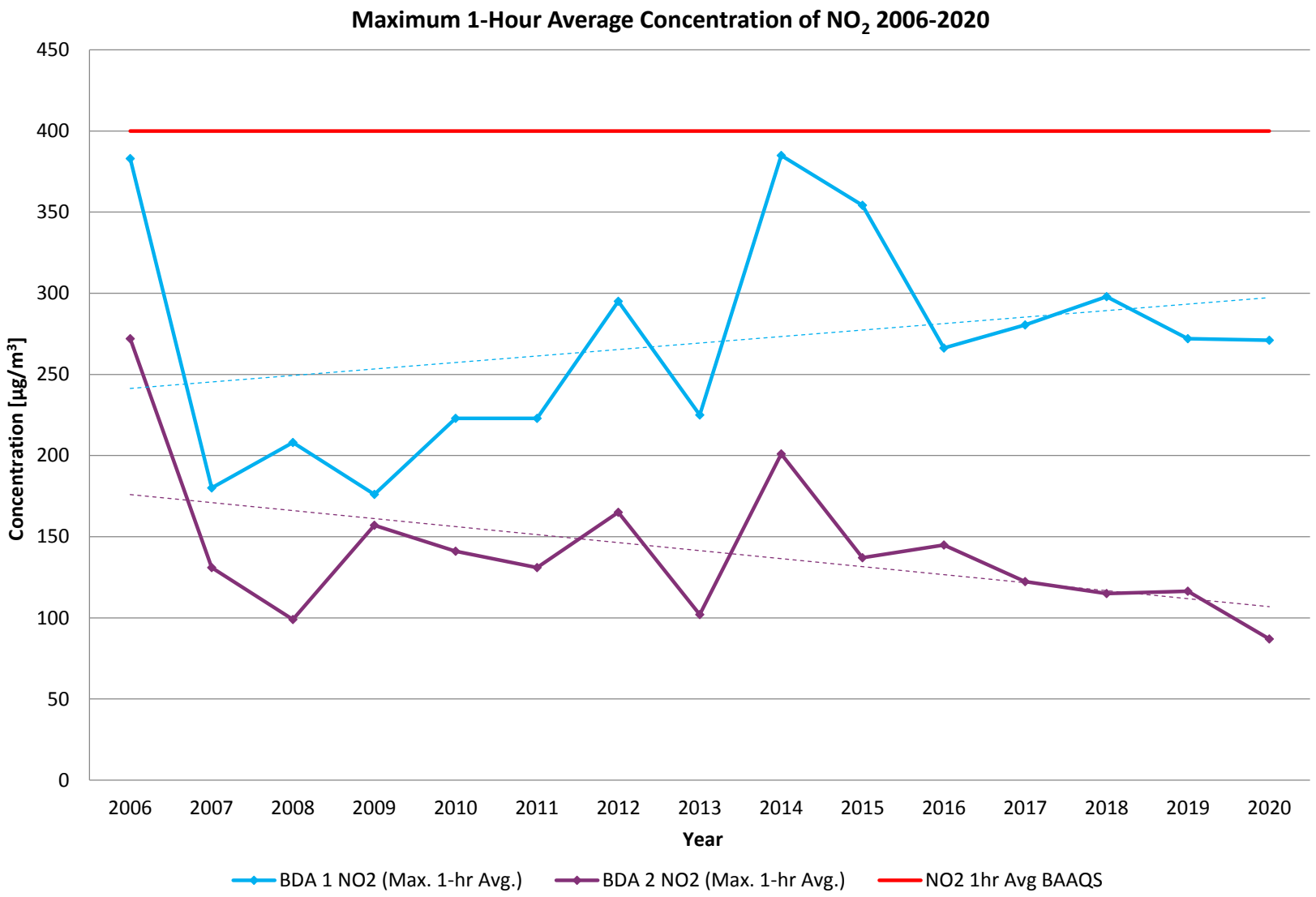

Figure 4 - Maximum 1-Hour Average Concentration of NO_2 Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

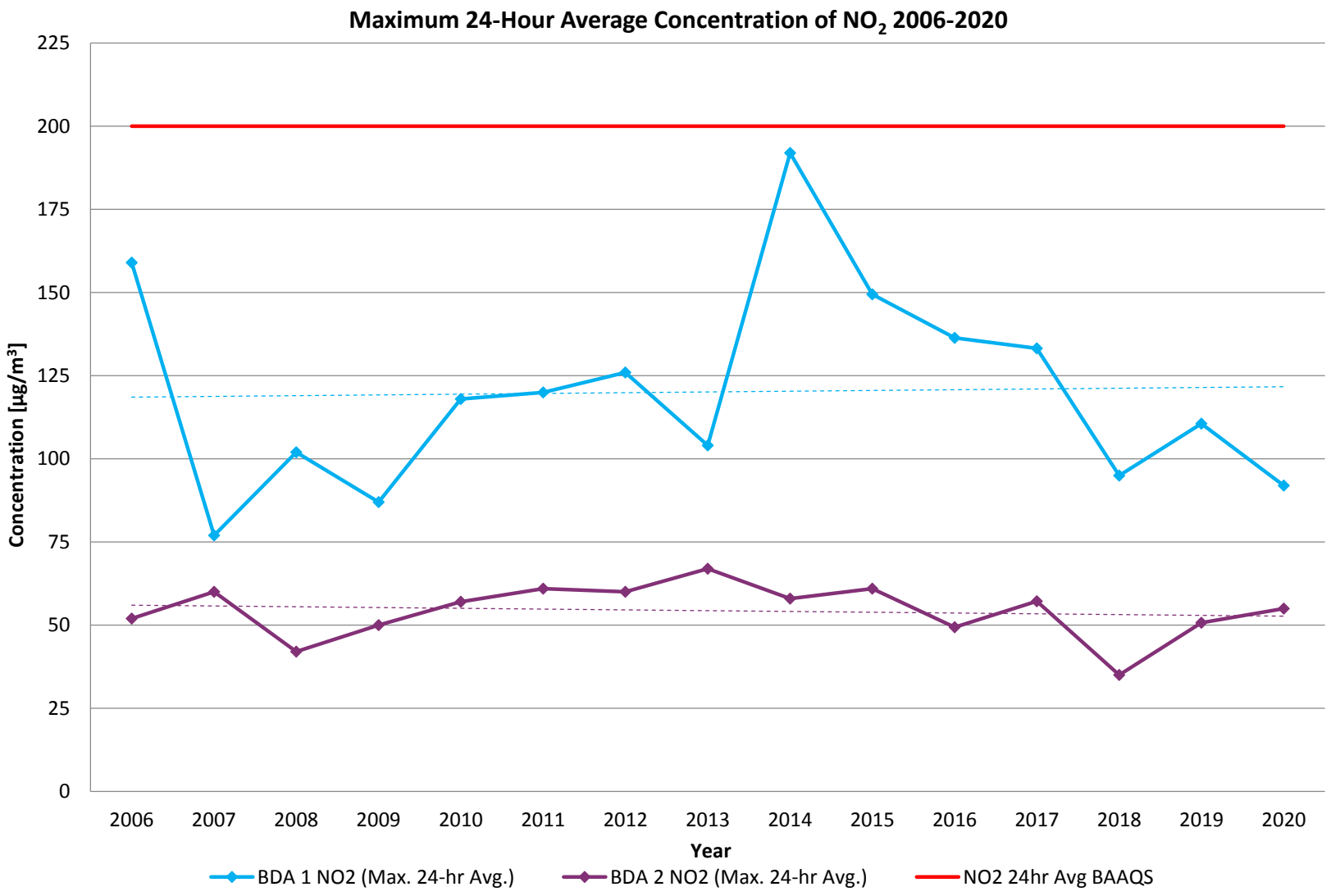

Figure 5 - Maximum 24-Hour Average Concentration of NO_2 Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

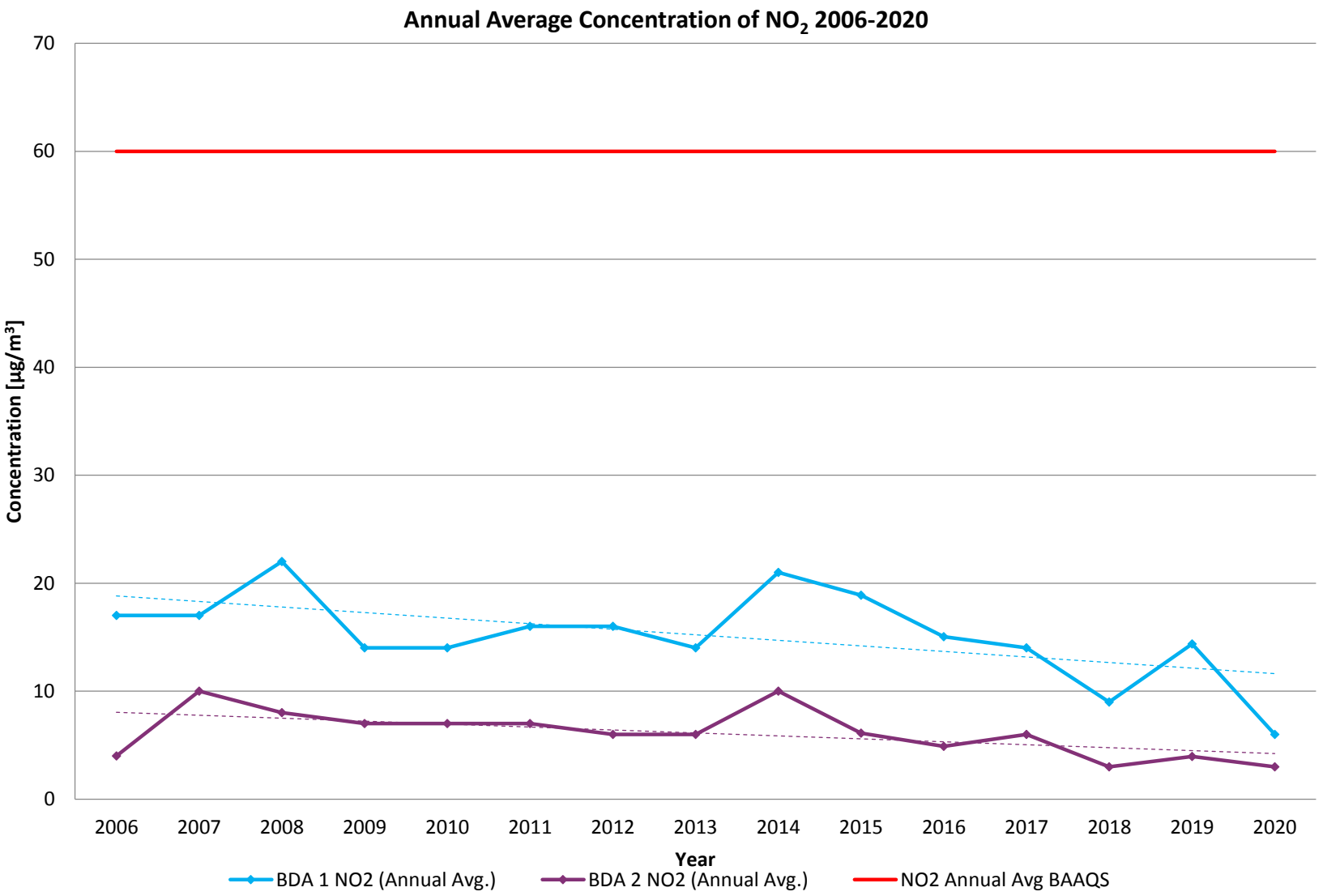

Figure 6 - Annual Average Concentration of NO_2 Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

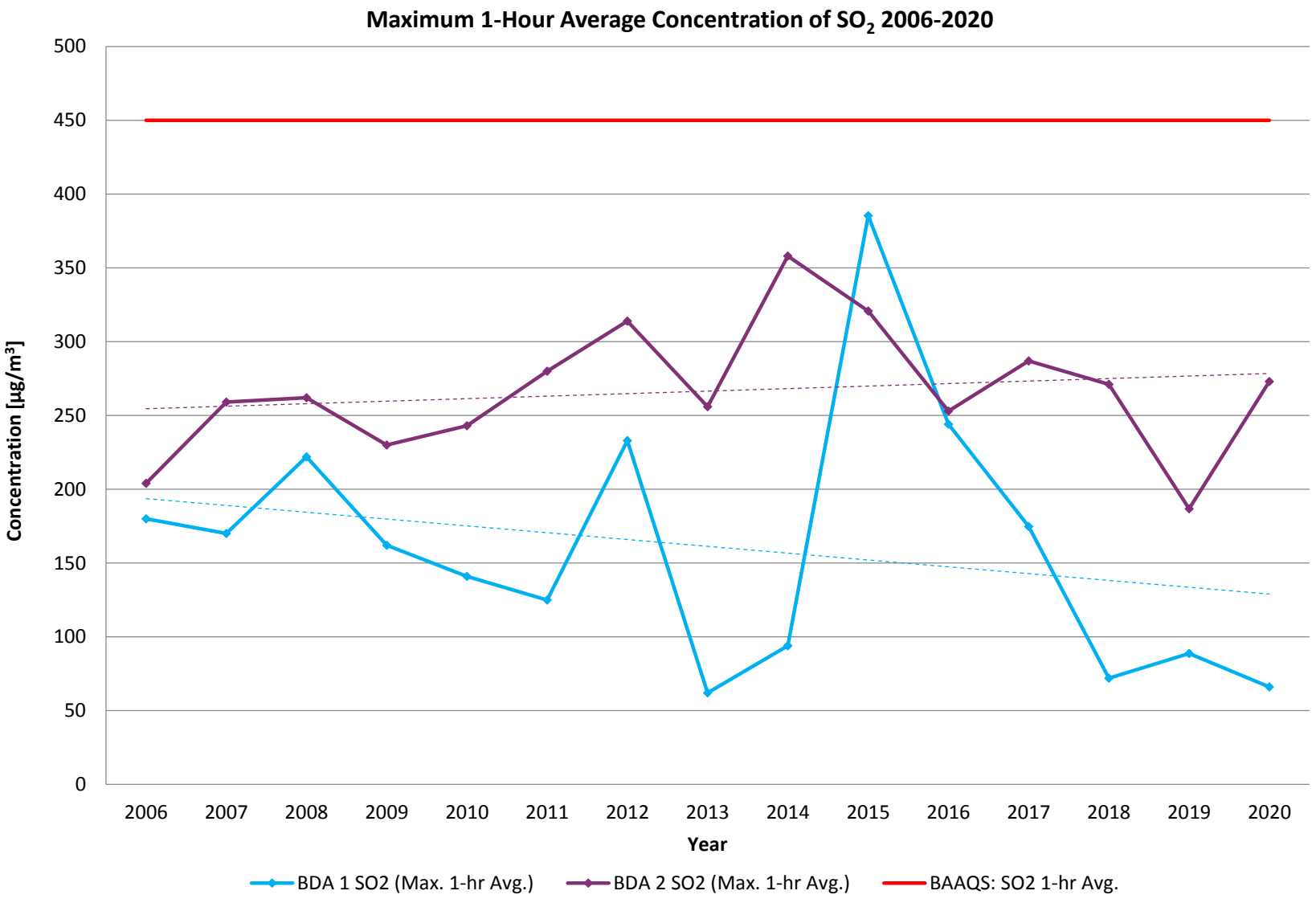

Figure 7 - Maximum 1-Hour Average Concentration of SO_2 Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

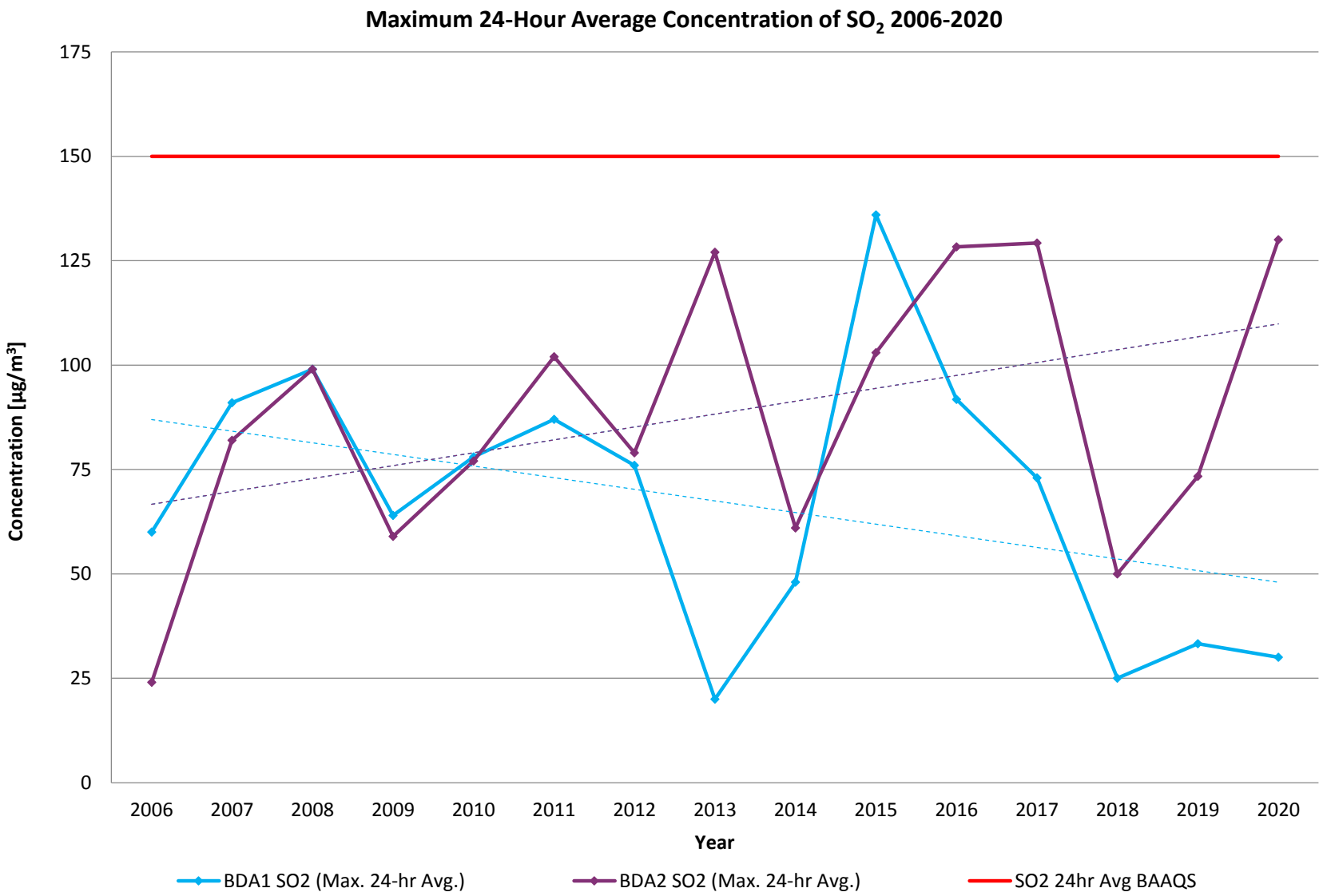

Figure 6 - Maximum 24-Hour Average Concentration of SO_2 Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

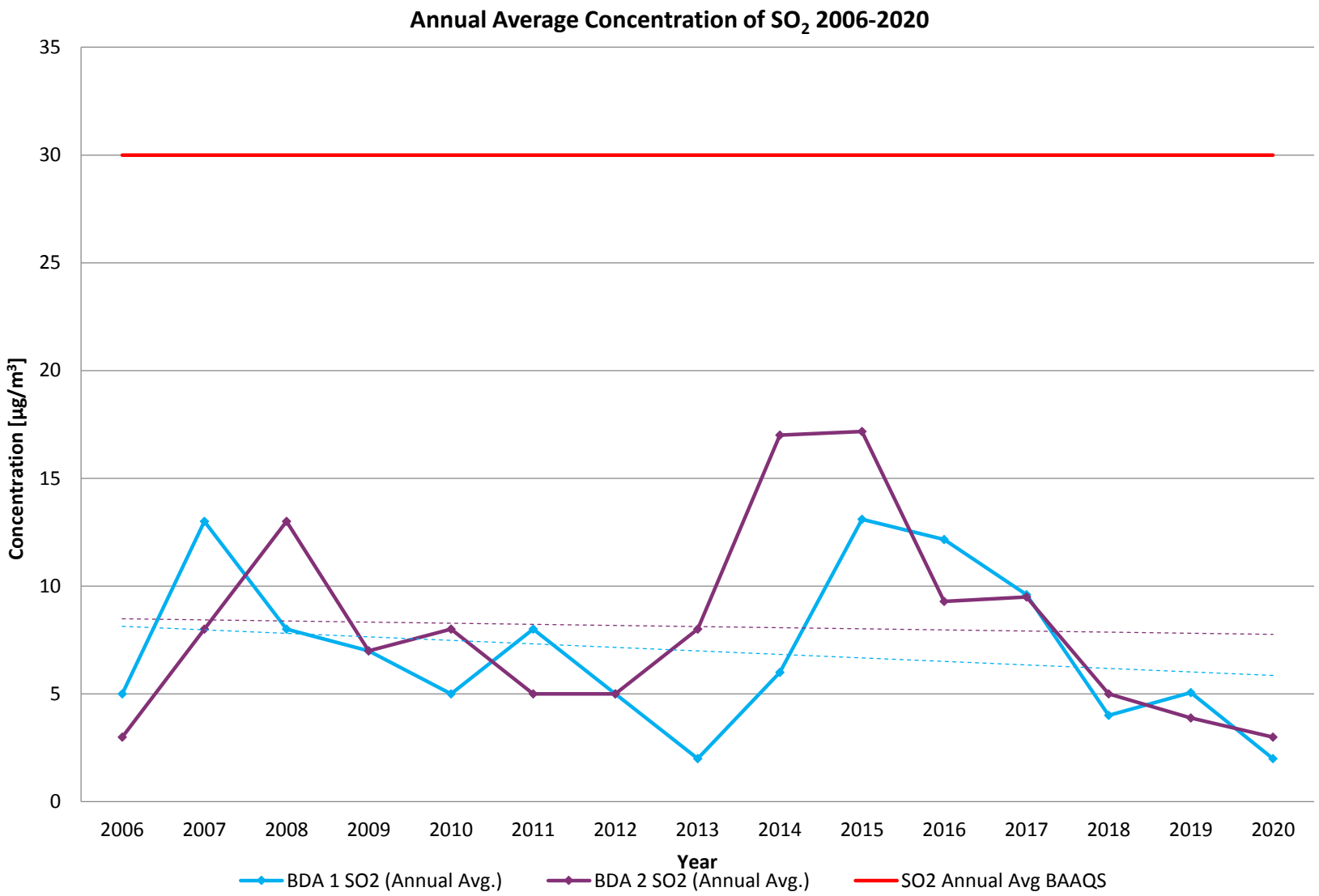

Figure 8 - Annual Average Concentration of SO_2 Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

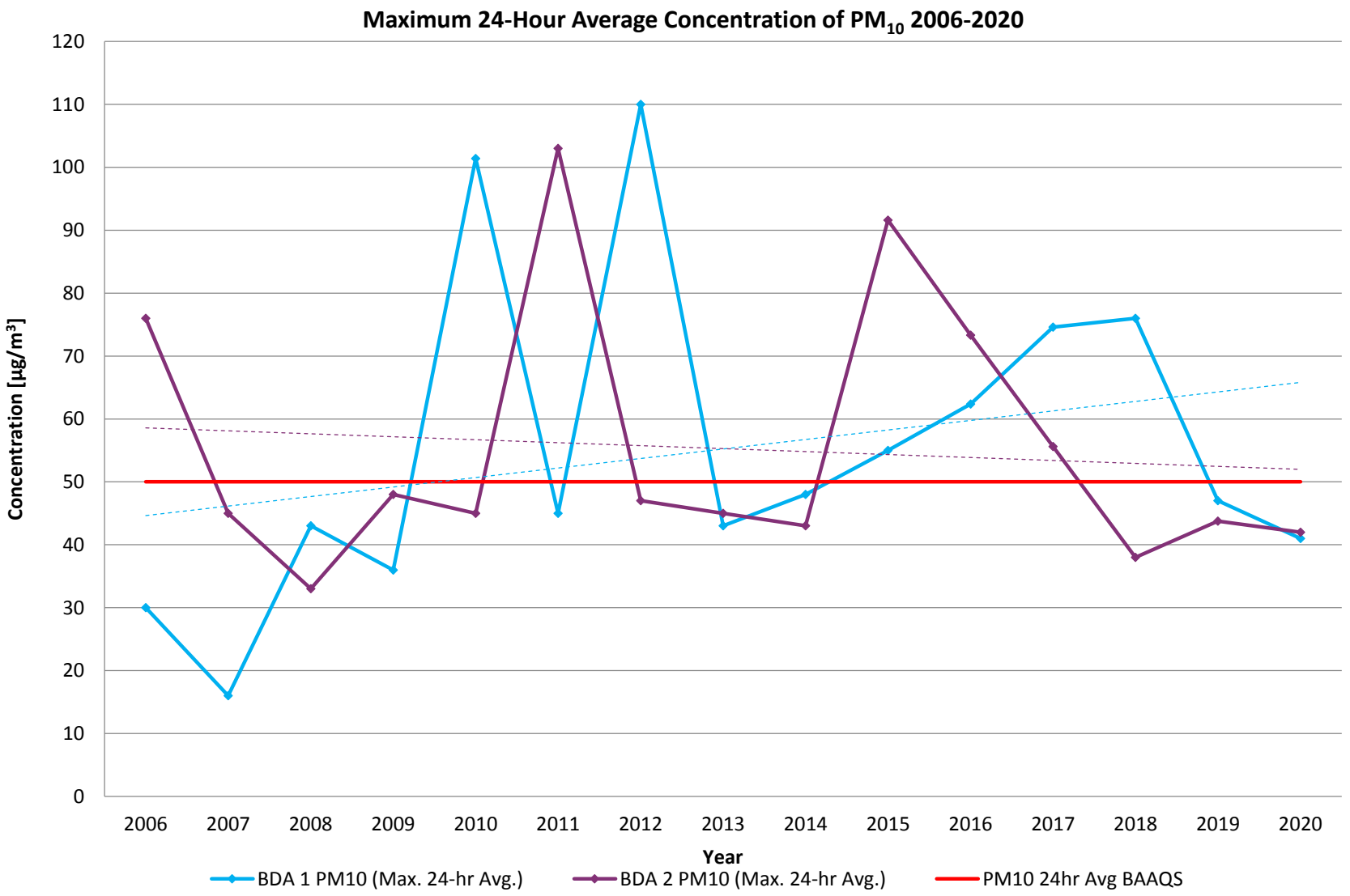

Figure 9 - Maximum 24-Hour Average Concentration of PM_{10} Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

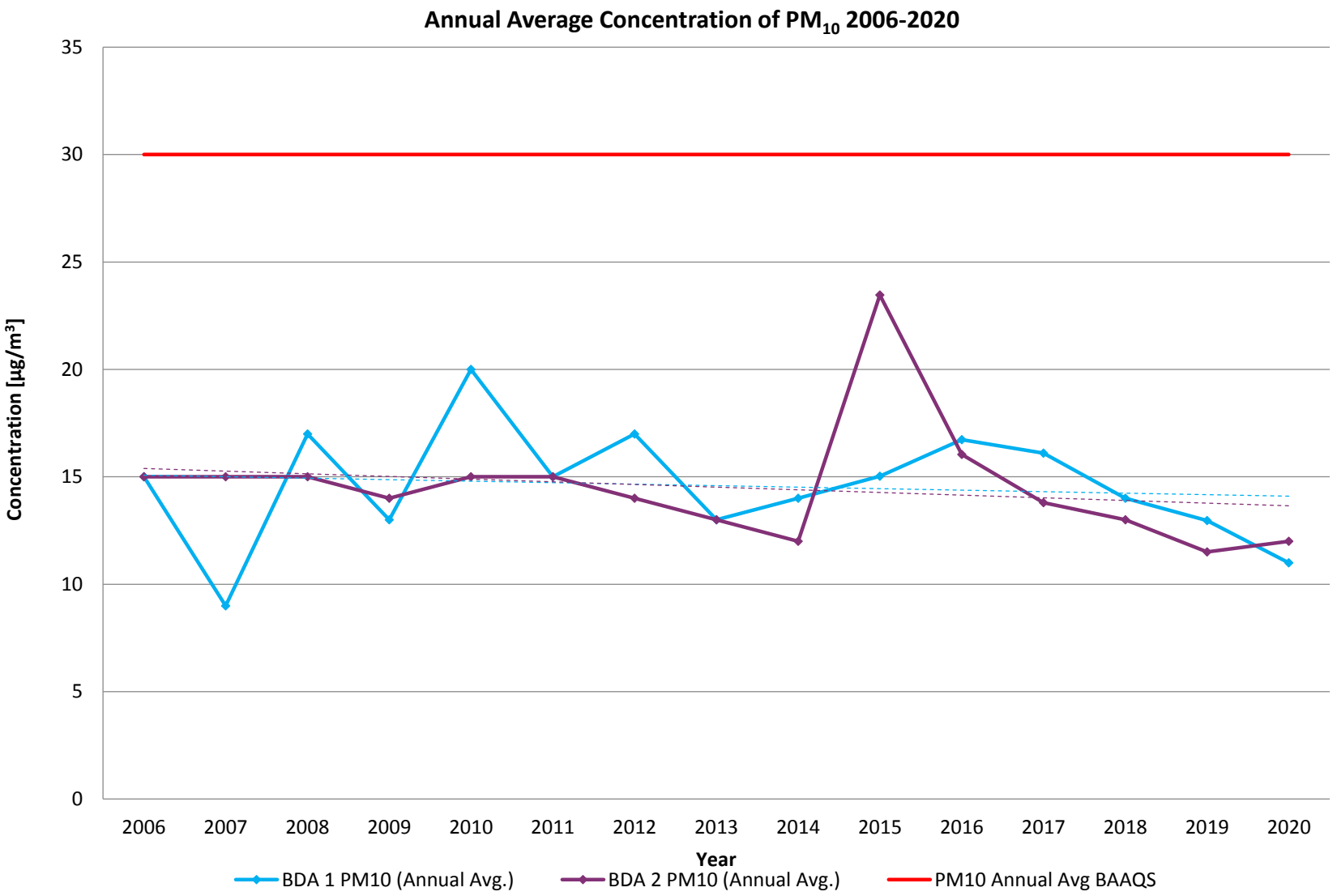

Figure 10 - Annual Average Concentration of PM_{10} Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

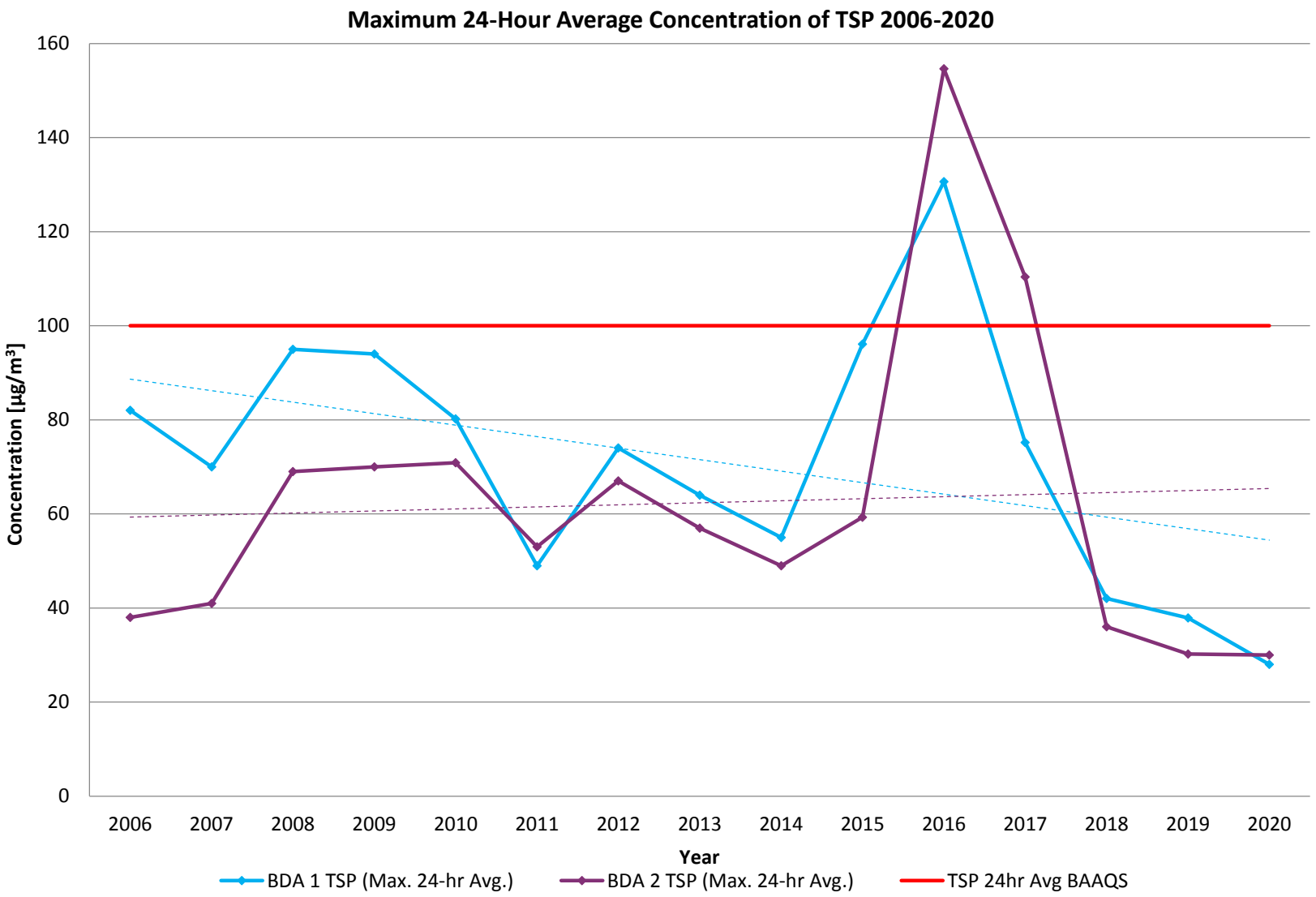

Figure 11 - Maximum 24-Hour Average Concentration of TSP Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

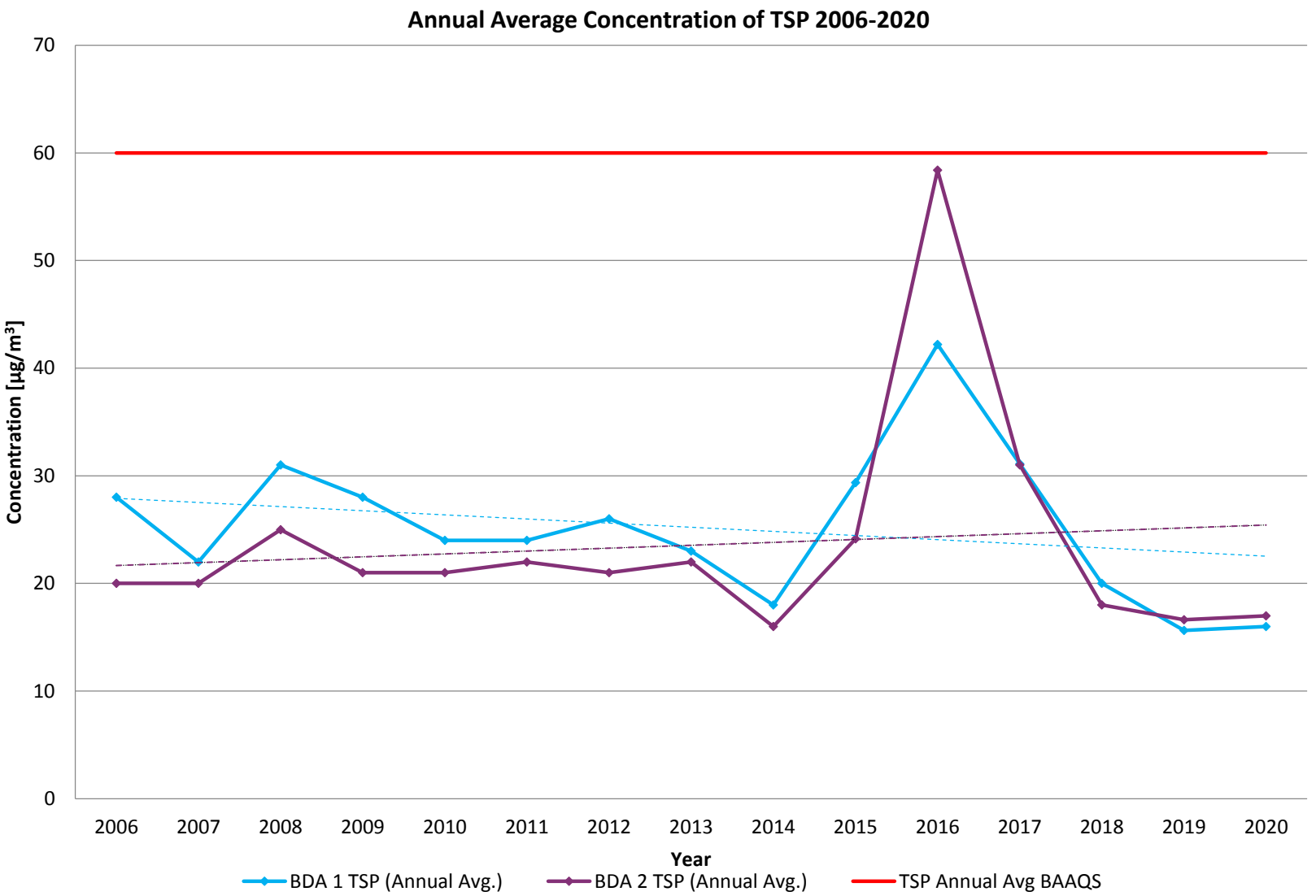

Figure 12 - Annual Average Concentration of TSP Recorded at BDA1 and BDA2 Monitoring Stations 2006-2020

Semiannual Audits

Due to the COVID-19 pandemic and the associated travel restrictions imposed throughout much of 2020, an auditor from Environmental Engineering & Measurement Services, Inc. was unable to travel to Bermuda to perform the two (2) independent audits of BELCO's Air Quality Monitoring System (AQMS) in 2020 required by condition 5.4.7 of BELCO's Operating License Conditions.

Conclusion

Zero (0) exceedances of the BAAQS were recorded during this reporting period. Annual average concentrations of all gaseous and particulate parameters were measured to be below Bermuda Ambient Air Quality Standards. All monitoring equipment was routinely maintained and calibrated throughout the year. Independent audits of BELCO's air quality monitoring program were unable to be completed in 2020 due to travel restrictions associated with the COVID-19 pandemic.