BERMUDA ELECTRIC LIGHT COMPANY LIMITED

ANNUAL OPACITY MONITORING REPORT

For the period

JANUARY 1ST, 2024 – DECEMBER 31ST, 2024

Submitted: February 28th, 2025

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BELCO

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Bermuda Electric Light Company Limited
Annual Opacity Monitoring Report
(January 1st, 2024 through December 31st, 2024)

Introduction

This report summarizes BELCO's Continuous Opacity Monitoring System for the period **January 1st, 2024 to December 31st, 2024** as required under Conditions 5.3 and 6.3 of BELCO's Operating Licence (OL-114). The report presents information related to BELCO's Opacity Monitoring program previously reported in 2024 Quarterly Reports to the Environmental Authority and includes: summary data collected from the in-stack opacity instruments on the E7, E8, N1, N2, N3 and N4 engines; availability statistics and maintenance performed on all operating opacity instruments; the results for monthly visible emissions (VE); as well as a Non-Compliant Engine (NCE) summary for the year.

In-Stack Opacity Monitor Exceedances

Bermuda Clean Air Regulations 1993 limits emissions to a standard of 20 percent opacity over a six-minute average. However, BELCO's Operating Licence OL-114, limits emissions to a regulatory standard of 15 percent opacity over a six-minute block average as described in Section 5.3.2. Opacity emissions are presently measured using in-stack Continuous Opacity Monitoring Systems (COMS) on six (6) of BELCO's diesel engines (E7, E8, N1, N2, N3 and N4).

The COMS utilized in all installations consists of Teledyne Monitor Labs' Lighthawk Model 560 Compliance Opacity Monitors. It is noted that diesel engines E5 and E6 were not fitted with in-stack opacity meters and therefore BELCO's opacity emissions from these diesel engines were monitored in 2024 using monthly visual opacity observations as per EPA Alternative Method 9 & ALT-082.

During the 2024 monitoring period there was one (1) exceedance of the regulatory standard recorded by the in-stack opacity monitors. On December 31st, during the start-up of engine E7, the period to reach the target load was slower than usual due to operator error. This resulted in an exceedance of 24.33% average opacity for 23 minutes, 3 minutes over the regulated 20-minute allowance for opacity greater than 15% during start-up and shut-down.

Since 2010, there has been a significant reduction in the number of opacity exceedances reported (**Figure 1**). This is an example of BELCO's continued effort to improve our Standard Operating Procedures (SOP's) and operate more efficiently. All remaining exceedances recorded by the in-stack opacity monitors presented in the quarterly reports are permitted under Section 5.3.2. of BELCO's Operating Licence.

Data Availability

Data availability throughout the reporting period was considered generally high on all in-stack opacity units in 2024 (**Figure 2**). The 2024 annual cumulative availability average for each unit was 99.81%, 99.58%, 99.15%, 97.20%, 99.02%, 98.15% for opacity monitors on E7, E8, N1, N2, N3 and N4 respectively. Note, N3 Engine was out of service for all of Q2 2024, therefore had a 0.00% Data availability and was not included in the annual average. Overall, all COMS yearly average values

met the 95% data availability target for 2024, with a combined average of 98.82% at the end of 2024.

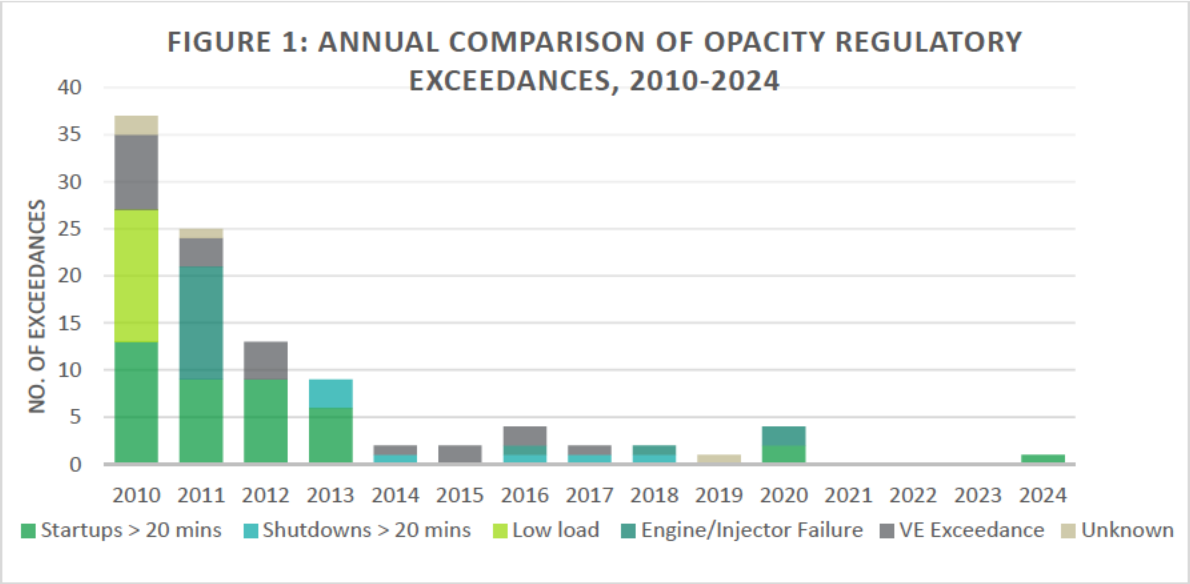

Figure 1: Comparison of Opacity Monitor Regulatory Exceedances 2010-2024
(Before Dec 2021, data represents Startup and Shutdown exceedances of the regulated 30-minute time frame)

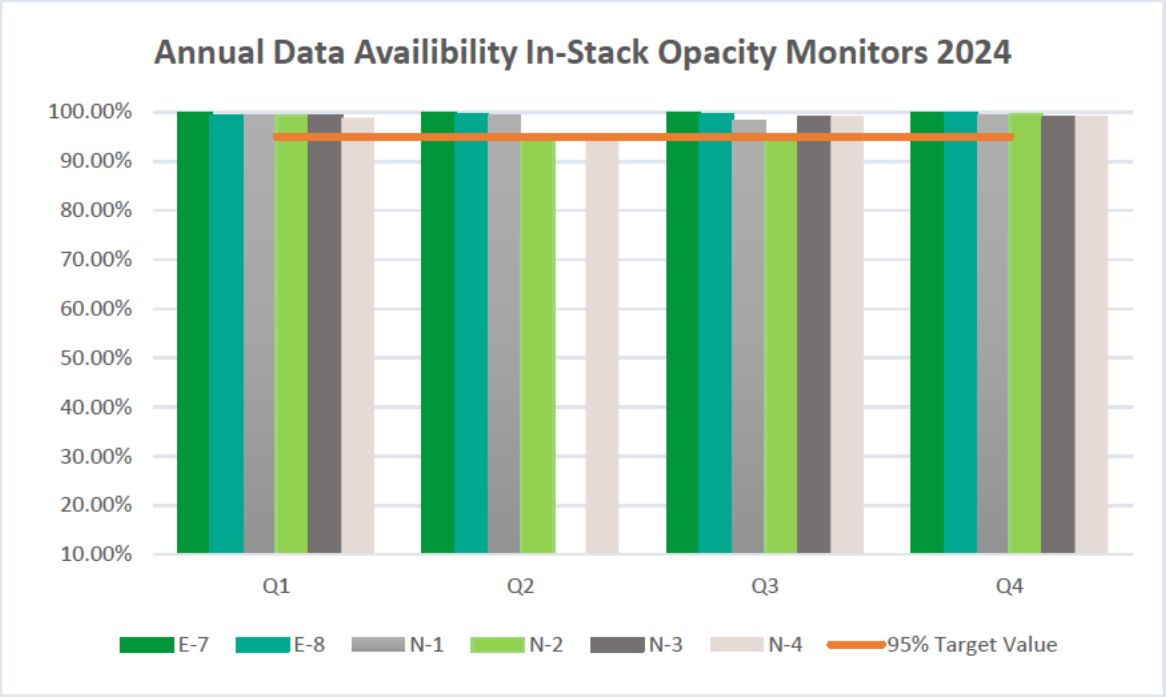

Figure 2: Annual Data Availability of In-Stack Opacity Monitors 2024

Opacity System Calibration and Maintenance

Each COMS instrument is challenged daily and is required to pass a zero (0%) and span calibration (25-28%). Annual calibration drift data indicated that for the six active opacity monitors, 45 of a possible 2,190 total daily calibrations failed in 2024. Is it noted that the E8 unit failed 40 daily calibrations due to a failure of the unit's flange in Q1, which was repaired during the semi-annual service. Additionally, the N4 unit failed 3 daily calibrations due to the island wide outage in Q2, the N3 unit failed 2 daily calibrations during preparation for engine run-in after alternator repair in Q3, and all engines passed daily calibrations in Q4.

All reported opacity data that followed a failed calibration was flagged as invalid in CEMLink6 until such time a successful calibration was achieved. In many cases, the COMS instrument self-corrected while for more serious failures a maintenance visit was required for instruments that did not self-correct. In accordance with BELCO's Operating License #OL-114, DENR was notified of all issues that resulted in significant data loss.

Regular bi-monthly maintenance was scheduled and executed by BELCO Bulk Generation Electrical Instrumentation & Control personnel on all operating COMS throughout the 2024 period. The semi-annual maintenance of the opacity monitoring system and software was performed in March and September 2024 by VIM Technologies. During these service visits, VIM Technologies performed all maintenance and inspections required by the Teledyne Monitor Labs Lighthawk Opacity monitors installed on Engines E7, E8, N1, N2, N3 and N4 and the associated VIM CEMLink 6 Data Acquisition System (DAS). A summary of VIM's maintenance visits are provided in **Appendix I**.

Visible Emissions Monitoring

Visible Emissions (VE) monitoring was completed monthly throughout 2024 for all active engines without dedicated COMS (i.e. E5 and E6) as well as the NPS engines for which there were no exceedances of the 15% regulatory standard recorded. Details of all visible emissions monitoring activities can be found in the quarterly reports previously submitted to the Environmental Authority.

BELCO maintained at least one certified visual opacity reader on staff at all times during 2024 as required under Conditions 5.3.4 of BELCO's Operating Licence #OL-114. All readers were certified by Eastern Technical Associates (ETA) in the case of U.S.E.P.A. Federal Reference Method 9, and Virtual Technology LLC in the case of U.S.E.P.A. Alternative Method 082 and utilizing ASTM D-7520-09 (ALT-082).

During the 2024 period BELCO held the following VE certifications:

Method 9: Kascia DaSilva, Date of Certification February 13th, 2024, and August 13th, 2024, Certification Expiration February 14th, 2025.
Hannah Lampit, Date of Certification February 13th, 2024, Certification Expiration August 14th, 2024.

ALT-082: Gabriel Cabrall, Date of Certification October 4, 2017
Kascia DaSilva, Date of Certification September 12, 2018
Hannah Lampit, Date of Certification September 18, 2023

The ALT-082 certification from Virtual Technology LLC is maintained by the submission of a valid observation on a semi-annual basis. **Appendix II** contains copies of all Visible Emissions Evaluator and Digital Still Camera Operator Certificates.

Operation of Non-Compliant Engines (NCEs)

The Environmental Authority's approval for NCE operation shall be requested on a case by case basis by BELCO as per the Appendix of BELCO's Operating License by the Department of Environment & Natural Resources' Environmental Authority. There were no engines assigned NCE status by BELCO for this reporting period. Therefore, there was no NCE operation in 2024.

Conclusion

During the 2024 monitoring period there was one (1) exceedances of the regulatory standard for opacity recorded by the in-stack opacity monitors. On December 31st, the start-up of engine E7 resulted in an exceedance of 24.33% average opacity for 23 minutes due to operator error.

All six continuous opacity monitors passed daily calibration drift tests in 2024 with the exception of E8 in Q1, N4 in Q2 and N3 in Q3. This represents a total of forty-five (45) failed daily calibration drift tests of a possible 2,190 for all opacity monitors in 2024.

Each unit's data availability met US EPA data availability requirements. Data availability throughout the period was high with a combined average of 98.82% at the end of 2024.

Visible Emissions Monitoring was completed monthly throughout the period for which there were no exceedances of the 15% regulatory standard recorded. BELCO maintained a certified VE reader in both EPA Method 9 and/or Alternative Method 082 specifications on staff at all times during 2024.

Maintenance of the opacity monitoring system was routinely performed throughout 2024. Bi-monthly maintenance was performed by BELCO Instrumentation and Control personnel, whilst semi-annual maintenance was performed by VIM personnel. The latter comprising of detailed on and off-stack calibrations for COMS in March and September 2024.

There were no engines assigned NCE status in 2024 and therefore no NCE operations in 2024.