

STANDARD OPERATING PROCEDURE

Use of Portable Analyzer for

Title V Semi-Annual Testing

Version 2.0 (Effective 04/01/01)

The North Dakota Department of Health approves the use of portable analyzers to measure NO_x and CO emissions with quality assurance procedures equivalent to EPA Test Methods in 40 CFR 60, Appendix A or the following minimum Standard Operating Procedure (SOP). Participants choosing to use portable analyzers must field test in parallel with a 3rd party tester at least once every five years, *using the testing team normally appointed with periodic monitoring duties.*

1. The tester may submit other quality assurance procedures for Department approval. The protocol must comply with the minimum requirements of the SOP. The protocol must address all pertinent information regarding the analyzer and all requirements as listed in the following sections.
2. The SOP is limited to measurements of NO_x (NO and NO₂), and CO.
3. Pre-Test Calibration/Linearity Check
 - A. The analyzer shall be calibrated prior to the emission test with calibration gases certified to ±2% accuracy.
 - B. Three calibration gases (zero, mid and high) for CO, NO and NO₂ shall be used. Purified ambient air may be used as the zero gas. The concentration of the high range calibration gas shall be no higher than 125% of the expected concentration nor less than 90% of the expected concentration. The mid calibration gas shall have a concentration that is 40 to 60% of the high range calibration gas.

- C. The analyzer calibration error shall be no more than $\pm 5\%$ of the calibration gas value for the mid and high range calibration gases, or 5 ppm, whichever is less restrictive. The calibration error shall be calculated as follows:

$$\% \text{ Difference} = \frac{\text{Analyzer Response} - \text{Gas Concentration}}{\text{Gas Concentration}} \times 100$$

For the zero gas, the calibration error shall be no more than 10 ppm:

$$\text{ppm Difference} = \text{Analyzer Response} - \text{Zero Gas Concentration}$$

4. Cross Interference Check

- A. While performing the pre-test calibration, check for and record any response noted on one sensor while calibrating another cell. Interference shall be calculated using the following equation:

$$\% \text{ Interference} = \frac{\text{Analyzer Response}}{\text{Gas Concentration}} \times 100$$

Interference shall be no greater than $\pm 5\%$.

5. Emissions Testing

- B. Allow the analyzer to purge the calibration gases prior to beginning the emissions test.
- C. A test shall consist of three runs, with each run at least 20 minutes in length.
- D. Record the readings for CO, NO and NO₂ at 2 minute intervals during the 20 minute run.

6. Post-Test Calibration

- A. After a maximum of three valid 20-minute emissions tests, conduct a post-test calibration as follows for CO, NO and NO₂ calibration gases:
- i. Allow the analyzer to purge the gas sample until a stable zero reading is observed. Record the zero reading.
 - ii. Introduce the high range calibration gas to the analyzer and allow it to reach a stable reading. Record the analyzer reading.
 - iii. Introduce the mid range calibration gas to the analyzer and allow it to reach a stable reading. Record the analyzer reading.
- B. Calculate the difference to the pre-test calibration value. If the difference is greater than ±5% or 5 ppm, the emissions tests runs are invalid and must be repeated.

$$\% \text{ Difference} = \frac{\text{Post Test Reading} - \text{Pre Test Reading}}{\text{Pre Test Reading}} \times 100$$

For the zero gas, the calibration error shall be no more than 10 ppm.

7. Stack Gas Volumetric Flow and Moisture Content

The stack gas volumetric flow and moisture content may be determined using 40 CFR 60, Appendix A, Methods 1-4 or by knowledge of fuel gas composition and combustion stoichiometry. Combustion stoichiometry may be used to determine stack flow only if quality assurance procedures are submitted to the Department and approved prior to use in the field.

Notes:

The purpose of the SOP is not to replace the Reference Methods of 40 CFR 60, Appendix A, but to facilitate the measurement of emissions from sources that require periodic emissions testing.

The Department will not accept any portable analyzer test unless all the above conditions are met or a separate testing protocol has been approved in advance by the Department.

The Department reserves the right to withdraw or modify this SOP without advance notice.

Emission Test Worksheet

Date _____

Testing Crew _____

Company & Station _____

Engine Serial No. _____ Unit Number (EUI) _____

Engine rpm _____ Normal Operating rpm _____

Suction/Discharge Pressures _____

NO Pre-Test Calibration

NO Calibration Gas	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference
Zero	-		ppm
Mid Range			%
High Range			%

NO₂ Pre-Test Calibration

NO ₂ Calibration Gas	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference
Zero	-		ppm
Mid Range			%
High Range			%

CO Pre-Test Calibration

CO Calibration Gas	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference
Zero	-		ppm
Mid Range			%
High Range			%

$$\% \text{ Difference} = \frac{\text{Analyzer Response} - \text{Gas Concentration}}{\text{Gas Concentration}} \times 100 \leq 5\% \text{ or } 5 \text{ ppm}$$

$$\text{ppm Difference} = \text{Analyzer Response} - \text{Zero Gas Concentration} \leq 10 \text{ ppm}$$

Company & Station _____

Unit Number (EUI) _____

Cross Interference Check

Gas	Span Concentration	CO Cell Response	NO Cell Response	NO ₂ Cell Response	% Interference	
CO		-				
NO			-			
NO ₂				-		

NO Post-Test Calibration

NO Calibration Gas	Pre-Test Analyzer Response	Post-Test Analyzer Response	Difference
Zero			ppm
Mid Range			%
High Range			%

NO₂ Post-Test Calibration

NO ₂ Calibration Gas	Pre-Test Analyzer Response	Post-Test Analyzer Response	Difference
Zero			ppm
Mid Range			%
High Range			%

CO Post-Test Calibration

CO Calibration Gas	Pre-Test Analyzer Response	Post-Test Analyzer Response	Difference
Zero			ppm
Mid Range			%
High Range			%

$$\% \text{ Interference} = \frac{\text{Analyzer Response}}{\text{Gas Concentration}} \times 100 \leq 5\%$$

$$\% \text{ Difference} = \frac{\text{Post Test Reading} - \text{Pre Test Reading}}{\text{Pre Test Reading}} \times 100 \leq 5\% \text{ or } 5 \text{ ppm}$$

Emission Tests

Run	Time	CO (ppm)	NO (ppm)	NO ₂ (ppm)	NO _x (ppm)
1	0:02				
	0:04				
	0:06				
	0:08				
	0:10				
	0:12				
	0:14				
	0:16				
	0:18				
	0:20				
	average				
2	0:02				
	0:04				
	0:06				
	0:08				
	0:10				
	0:12				
	0:14				
	0:16				
	0:18				
	0:20				
	average				
3	0:02				
	0:04				
	0:06				
	0:08				
	0:10				
	0:12				
	0:14				
	0:16				
	0:18				
	0:20				
	average				

$$\text{NO}_x \text{ (ppm)} = \text{NO (ppm)} + \text{NO}_2 \text{ (ppm)}$$