SUMMARY SHEET 7
Nitrogen Oxides

			Run #1	Run #2	Run #3	Avg
Client/Plant Name		FDS 7				
Job No.		FDS 7				
Sampling Location		FDS 7				
Run ID#		FDS 7				
Test Date		FDS 7				
Run Start Time		FDS 7				
Run Finish Time		FDS 7				
Traverse Points (if applicable)		FDS 7				
Initial Temperature, °F	t_i	FDS 7				
Initial Absolute Temperature, R	T_i	SS 7				
Final Temperature, °F	t_f	FDS 7				
Final Absolute Temperature, R	T_f	SS 7				
Initial Barometric Pressure, in. Hg	P_{bi}	FDS 7				
Initial Vacuum, in. Hg	P_{gi}	FDS 7				
Initial Absolute Pressure, in. Hg	P_i	SS 7				
Final Barometric Pressure, in. Hg	P_{bf}	FDS 7				
Final Vacuum, in. Hg	P_{gf}	FDS 7				
Final Absolute Pressure, in. Hg	P_f	SS 7				
Flask Volume, mL	V_f	CDS 7				
Volume Absorbing Reagent, mL	V_a	FDS 7				
Gas Sample Volume, mL	V_{sc}	SS 7				
Spectrophotometer Calibration Factor	K_c	LDS 7				
Sample Solution Volume, mL		LDS 7				
Average NO_2 Per Sample, μg	m_{avg}	LDS 7				
Sample Concentration, lb/dscf	C	SS 7				
Audit Relative Error, %	RE	QA1				
Post-test Calibration Checks Temperature, Barometer, and Vacuum Gauges		CDS 2d				

Note: *Consider P_{gi} and P_{gf} to be positive.*

$$V_{sc} = 17.64\ (V_f - V_a)\left[\frac{(P_{bf} - P_{gf})}{(460 + t_f)} - \frac{(P_{bi} - P_{gi})}{(460 + t_i)}\right]$$

$$C = 6.242 \times 10^{-5}\ \frac{m_{avg}}{V_{sc}}$$

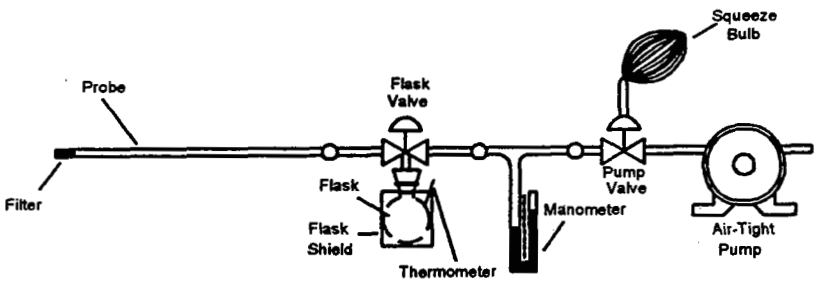

Figure F7-1. Sampling Train, Flask Valve, and Flask.

FIELD PROCEDURE 7
Nitrogen Oxides (Evacuated Flask)

Note: Except for some minor variations, this procedure is also used for Method 7A or 7B.

A. Pre-test Preparation

1. Pipette 25 mL of absorbing solution into a sample flask.
2. Retain enough absorbing solution to prepare the calibration standards.

B. Sampling

1. Assemble the sampling train as shown in Figure F7-1, and place the probe at the sampling point.
2. Ensure that all fittings are tight and leak-free, and that all ground glass joints have been greased properly with a high-vacuum, high-temperature chlorofluorocarbon-based stopcock grease.
3. Evacuate the flask to ≤3 in. Hg absolute pressure, preferably to the vapor pressure of water at existing temperature.
4. Check for leakage by observing the manometer for any pressure fluctuation (must not vary >0.4 in. Hg in 1 min).
5. Record the data as shown in FDS 7.
6. Purge the probe and the vacuum tube using the squeeze bulb. If condensation occurs in the probe and the flask valve area, heat the probe, and purge until the condensation disappears.
7. Take flask pressure readings.
8. Extract sample slowly until pressures in the flask and sample line (i.e., duct, stack) are equal (usually 15 sec); a longer period indicates a "plug" in the probe.
9. After collecting the sample, close the flask valve, and disconnect the flask from the sampling train.
10. Shake the flask for at least 5 min and let the flask set for ≥16 hr.

C. Sample Recovery

1. Shake the contents for 2 min.
2. Connect the flask to a mercury filled U—tube manometer.
3. Open the valve from the flask to the manometer, and record the flask temperature, the barometric pressure, and the flask vacuum.
4. Transfer the contents of the flask to a leak-free polyethylene bottle. Rinse the flask twice with 5-mL portions of deionized distilled water, and add the rinse water to the bottle.
5. Adjust the pH to between 9 and 12 by adding 1 N NaOH, dropwise (about 25 to 35 drops). Check the pH by dipping a stirring rod into the solution and then touching the rod to the pH test paper. Remove as little material as possible during this step.
6. Seal and label the container. Mark the height of the liquid level.

D. Post-test Calibrations

Calibrate thermometers, barometer, and vacuum gauges (if other than mercury manometer). **See CP 2d, 2e, and 2f.**

E. Method 7A

1. FP 7A is the same as that for FP 7, except omit step C5 (adjusting the pH). **Use FDS 7.**
2. FP 7A may be subject to a low bias when SO_2 >2000 ppm.

F. Method 7B

1. Apply this procedure to emissions from nitric acid plants only.
2. Follow the procedure in FP 7 up and including step C2. **Use FDS 7.** Do not increase H_2O_2 concentration.
3. Transfer the contents of the flask to a 100-mL volumetric flask.
4. Rinse the flask three times with 10-mL portions of deionized distilled water, and add to the volumetric flask.
5. Dilute to 100 mL with deionized distilled water. Mix thoroughly. Analyze the sample **(see LP 7B).**

G. Sampling Gas Stream with Insufficient Oxygen

Introduce oxygen into flask by one of the following three methods:

1. Before evacuating the sampling flask, flush with pure cylinder oxygen, then evacuate flask to ≤3 in. Hg absolute pressure.
2. Inject oxygen into the flask after sampling.
3. Terminate sampling with a minimum of 2 in. Hg vacuum remaining in the flask, record this final pressure, and then vent the flask to the atmosphere until the flask pressure is almost equal to atmospheric pressure.

FIELD DATA SHEET 7
Evacuated Flask Sample

Method (Circle) 7 7A 7B

Client/Plant Name _____ Job # _____

City/State _____ Date/Time _____

Test Location/Run # _____ Personnel _____

Clock Time	Steps		Sample #	Sample #	Sample #	Sample #
	Initial Vacuum (≤3 in. abs ?)	(in. Hg)				
	Leak Check (≤0.4 in. Hg/min ?)	(in. Hg)				
	Flask ID/Valve #					
	Flask/Valve Volume	(cc)				
	Initial Temperature, t_i	(°F)				
	Initial Barometric Pressure, P_{bi}	(in. Hg)				
	Purge (no condensation?)	(✓)				
	Initial Vacuum (Leg A + Leg B), P_{gi}	(in. Hg)				
	Initial Pressure, P_i	(in. Hg)				
	Shake for 5 minutes ?	(✓)				
	Flask stand for ≥16 hr ?	(✓)				
	Shake for 2 minutes ?	(✓)				
	Final Flask Temperature, t_i	(°F)				
	Final Barometric Pressure, P_{bf}	(in. Hg)				
	Final Vacuum (Leg A + Leg B), P_{gf}	(in. Hg)				
	Final Pressure, P_f	(in. Hg)				
	Adjust pH (9-12), M7 only?	(✓)				
	Seal and mark liquid level?	(✓)				
	Label container ?	(✓)				
	Sample Volume, V_{sc}	(mL)				

$$V_{sc} = 17.64\ (V_f - V_a)\left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right]$$

Add 460 to t_f and t_i to obtain T_f and T_i, respectively.

Post-test Calibrations

Attach FDS 2d for pressure, barometric pressure, and temperature post-test checks (temperature ≤ ±2°F).

QA/QC Check

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____ _____
Personnel (Signature/Date) Team Leader (Signature/Date)

LABORATORY PROCEDURE 7
Nitrogen Oxides

A. Reagent Preparation

1. Hydrogen Peroxide, 3%. Dilute 30% H_2O_2 1:9 with deionized distilled water. Prepare fresh daily.
2. Absorbing Solution. Cautiously add 2.8 mL conc. H_2SO_4 to 1 L of deionized distilled water. Mix well, and add 6 mL 3% H_2O_2. Use within 1 week of preparation. Do not expose to extreme heat or direct sunlight.
3. Sodium Hydroxide, 1 N. Dissolve 40 g NaOH in deionized distilled water, and dilute to 1 L.
4. Potassium Nitrate Standard. Dry KNO_3 at 105 to 110°C for at least 2 hr just before preparation. Dissolve exactly 2.198 g dried KNO_3 in deionized distilled water, and dilute to 1 L with deionized distilled water in a 1000-mL volumetric flask.
5. Working Standard KNO_3 Solution, 100 μg NO_2/mL. Dilute 10 mL standard solution to 100 mL with deionized distilled water.
6. Phenoldisulfonic Acid Solution. Dissolve 25 g pure white phenol solid in 150 mL conc. H_2SO_4 on a steam bath. Cool, add 25 mL fuming H_2SO_4 (15 to 18% by weight free sulfur trioxide - HANDLE WITH CAUTION), and heat at 100°C for 2 hr. Store in a dark, stoppered bottle.
7. QA Audit Samples. Obtain from EPA **(see QA 1).**

B. Spectrophotometer Calibration Factor K_c

1. Calibrate the wavelength scale of the spectrophotometer, if not done within the past six months. **(See CP 7a).**
2. Add 0.0 mL, 2.0 mL, 4.0 mL, 6.0 mL, and 8.0 mL of the KNO_3 working standard solution (1 mL = 100 μg NO_2) to a series of five 50-mL volumetric flasks.
3. To each flask, add 25 mL of absorbing solution, 10 mL deionized distilled water, and 1 N NaOH dropwise until the pH is between 9 and 12 (about 25 to 35 drops each).
4. Dilute to the mark with deionized distilled water, and mix thoroughly.
5. Pipette a 25-mL aliquot of each solution into a separate porcelain evaporating dish.
6. Follow steps D6 through D13.
7. Measure the absorbance of each solution, at 410 nm or the wavelength determined in CP 7a.
8. Repeat this calibration procedure on each day that samples are analyzed.
9. Calculate the spectrophotometer calibration factor K_c.

C. Spectrophotometer Calibration Quality Control

1. Multiply the absorbance value obtained for each standard by the K_c factor (least squares slope) to determine the distance each calibration point lies from the theoretical calibration line.
2. These calculated concentration values should not differ from the actual concentrations (i.e., 100, 200, 300, and 400 μg NO_2) >7% for three of the four standards.

D. Analysis

1. Note the level of the liquid in the sample containers, and determine loss; note this loss, if any, on the analytical data sheet.
2. Immediately prior to analysis, transfer the contents of the shipping container to a 50-mL volumetric flask, and rinse the container twice with 5-mL portions of deionized distilled water.
3. Add the rinse water to the flask, and dilute to mark with deionized distilled water; mix thoroughly.
4. Pipette a 25-mL aliquot into the porcelain evaporating dish.
5. Return any unused portion of the sample to the polyethylene storage bottle.
6. Evaporate the 25-mL aliquot to dryness on a steam bath, and allow to cool.
7. Add 2 mL phenoldisulfonic acid solution to the dried residue, and triturate thoroughly with a polyethylene policeman. Ensure the solution contacts all the residue.
8. Add 1 mL deionized distilled water and 4 drops of conc. sulfuric acid. Heat the solution on a steam bath for 3 min with occasional stirring. Allow the solution to cool.
9. Add 20 mL deionized distilled water, mix well by stirring. Add conc. ammonium hydroxide, dropwise, with constant stirring, until the pH is 10 (as determined by pH paper).
10. If the sample contains solids, filter as follows (centrifuging may also be used):
    a. Filter through Whatman No. 41 filter paper into a 100-mL volumetric flask.
    b. Rinse the evaporating dish with three 5-mL portions of deionized distilled water.
    c. Filter these three rinses.

d. Wash the filter with at least three 15-mL portions of deionized distilled water.

e. Add the filter washings to the contents of the volumetric flask, and dilute to the mark with deionized distilled water.

f. If solids are absent, transfer the solution directly to the 100-mL volumetric flask and dilute to the mark with deionized distilled water.

11. Mix the contents of the flask thoroughly, and measure the absorbance at the wavelength used for the standards, using the blank solution as a zero reference.

12. Dilute the sample and the blank with equal volumes of deionized distilled water if the absorbance exceeds A_4, the absorbance of the 400-μg NO_2 standard.

13. Concurrently analyze the two audit samples and a set of compliance samples, if applicable, in the same manner as the samples.

LABORATORY DATA SHEET 7
Nitrogen Oxides

Client/Plant Name _____ Job # _____

Analyst _____ Date/Time _____

Spectrophotometer ID# _____ Wavelength _____nm

Date of Last Calibration _____ *(≤6 months?)*

$$K_c = 100 \frac{A_1 + 2A_2 + 3A_3 + 4A_4}{A_1^2 + A_2^2 + A_3^2 + A_4^2} = \_\_\_\_\_$$

Volume of Working Std (mL)	(A) Mass NO_2 in Std (μg NO_2)	(B) Absorbance (OD)	(C) K_c A_i (μg NO2)	(C) - (A) (μg NO_2)	QC Chk (μg NO_2)
0.0	0	A_0			
2.0	100	A_1			≤ ±7?
4.0	200	A_2			≤ ±14?
6.0	300	A_3			≤ ±21?
8.0	400	A_4			≤ ±28?

Sample ID#	Volume Loss, V_l (mL)	Sample Volume, V_s (mL)	Aliquot Volume, V_a (mL)	Absorbance A (OD)	Mass/ Samp, m (μg NO_2)	Average m_{avg} (μg NO_2)
Audit Sample #1						
Audit Sample #2						

$m = 2 K_c A F$ 2 = 50/25 F = Dilution factor, if sample was diluted to bring absorbance into calibration range.

QA/QC Check

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____ _____

Personnel (Signature/Date) Team Leader (Signature/Date)

CALIBRATION PROCEDURE 7
Evacuated Flask

1. Assemble the flask and flask valve, and fill with deionized distilled water to the stopcock. A hypodermic syringe may be helpful.
2. Measure the volume of water to ±10 mL, using a 500-mL glass (Class A) graduated cylinder.
3. Make duplicate runs and average the volumes.
4. Record this average volume on the flask.
5. If flask valves are not switched, this calibration is required once.

CALIBRATION DATA SHEET 7
Evacuated Flasks

____ *500-ml glass (Class A) graduated cylinder?*

Date	Flask ID#	Flsk Valve ID#	Run #1 (cc)	Run #2 (cc)	Average (cc)	Personnel (Signature)

QA/QC Check
Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____
Team Leader (Signature/Date)

CALIBRATION PROCEDURE 7a
Spectrophotometer Calibration

Note: Recalibrate the wavelength scale of the spectrophotometer every 6 months as follows:

A. Calibration Check

1. Use an energy source with an intense line emission such as a mercury lamp, or use a series of glass filters spanning the measuring range of the spectrophotometer, to check the calibration of the spectrophotometer. Follow the manufacturer's recommended procedures.
2. The wavelength scale of the spectrophotometer must agree to within ±5 nm at all calibration points; otherwise, repair and recalibrate the spectrophotometer. Use 410 nm for all measurements of the standards and samples.

B. Alternative Calibration Check

1. If the instrument is a double-beam spectrophotometer, scan the spectrum between 400 and 415 nm using a 200 μg NO_2 standard solution in the sample cell and a blank solution in the reference cell. If no peak occurs, the spectrophotometer is probably malfunctioning; repair it. When a peak is within the 400 to 415 nm range, use the wavelength at which this peak occurs for the measurement of absorbance of both the standards and the samples.
2. For a single-beam spectrophotometer, follow the scanning procedure described above, except scan separately the blank and standard solutions. For the measurements of samples, use the wavelength at which the maximum difference in absorbance between the standard and the blank occurs.

CALIBRATION DATA SHEET 7b
Spectrophotometer
(Alternative Procedure)

Spectrophotometer ID# _____ Date _____

Personnel _____ Date of Prev. Cal. _____
(≤ 6 months between calibrations?)

*This data sheet is designed for a **single-beam spectrophotometer.** For a **double-beam spectrophotometer,** fill in the second column only.*

Spectrophotometer setting (nm)	Absorbance of 200 μg NO_2 Standard (OD)	Absorbance of blank (OD)	Actual Absorbance of Standard (OD)
399			
400			
401			
402			
403			
404			
405			
406			
407			
408			
409			
410			
411			
412			
413			
414			
415			
416			

____ Circle the wavelength at which the maximum peak absorbance (last column for single-beam and second column for double-beam) occurs.

____ If there is no peak absorbance, repair or recalibrate the spectrophotometer.

QA/QC Check
Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____ _____
Personnel (Signature/Date) Team Leader (Signature/Date)

SUMMARY SHEET 7A
Nitrogen Oxides

			Run #1	Run #2	Run #3	Avg
Client/Plant Name		FDS 7				
Job No.		FDS 7				
Sampling Location		FDS 7				
Run ID#		FDS 7				
Test Date		FDS 7				
Run Start Time		FDS 7				
Run Finish Time		FDS 7				
Traverse Points (if applicable)		FDS 7				
Initial Temperature, °F	t_i	FDS 7				
Initial Absolute Temperature, R	T_i	SS 7				
Final Temperature, °F	t_f	FDS 7				
Final Absolute Temperature, R	T_f	SS 7				
Initial Barometric Pressure, in. Hg	P_{bi}	FDS 7				
Initial Vacuum, in. Hg	P_{gi}	FDS 7				
Initial Absolute Pressure, in. Hg	P_i	SS 7				
Final Barometric Pressure, in. Hg	P_{bf}	FDS 7				
Final Vacuum, in. Hg	P_{gf}	FDS 7				
Final Absolute Pressure, in. Hg	P_f	SS 7				
Flask Volume, mL	V_f	CDS 7				
Volume Absorbing Reagent, mL	V_a	FDS 7				
Gas Sample Volume, mL	V_{sc}	SS 7				
Chromatographic Calibration Factor	S	LDS 7A				
Sample Solution Volume, mL		LDS 7A				
Average NO_2 Per Sample, μg	m	LDS 7A				
Sample Concentration, lb/dscf	C	SS 7A				
Audit Relative Error, %	RE	QA1				
Post-test Calibration Checks						
Temperature, Barometer, Vacuum Gauge		CDS 2d				

$$C = 6.242 \times 10^{-5} \frac{m}{V_{sc}}$$

LABORATORY PROCEDURE 7A
Nitrogen Oxides (Ion Chromatographic Method)

A. Reagent Preparation

1. Stock Standard Solution, 1 mg NO_2/mL. Dry $NaNO_3$ at 105 to 110°C for ≥2 hr just before preparing the standard solution. Dissolve exactly 1.847 g dried $NaNO_3$ in deionized distilled water, and dilute to 1 L in a volumetric flask. Mix well. Date this solution. Do not use after 1 month.
2. Working Standard Solution, 25 μg/mL. Dilute 5 mL of the standard solution to 200 mL with deionized distilled water in a volumetric flask, and mix well.
3. Eluent Solution, 0.0024 M Na_2CO_3/0.003 M $NaHCO_3$. Weigh 1.018 g Na_2CO_3 and 1.008 g $NaHCO_3$, and dissolve in 4 L deionized distilled water. Other eluents appropriate to the column type may be used.
4. Quality Assurance Audit Samples. Obtain from EPA **(see QA 1)**.

B. Sample, Standards, and Chromatograph Preparations

1. Analyze samples within 4 days after collection.
2. Note the level of the liquid in the container, and determine loss; note this loss, if any, on the laboratory data sheet.
3. Immediately before analysis, transfer the contents of the shipping container to a 50-mL volumetric flask, and rinse the container twice with 5-mL portions of deionized distilled water. Add the rinse water to the flask, and dilute to the mark with deionized distilled water. Mix thoroughly.
4. Pipet a 5-mL aliquot of the sample into a 50-mL volumetric flask, and dilute to the mark with deionized distilled water. Mix thoroughly. For each set of determinations, prepare a reagent blank by diluting 5 mL of absorbing solution to 50 mL with deionized distilled water. (Alternatively, eluent solution may be used in all sample, standard, and blank dilutions.)
5. Prepare a series of five standards by adding 1.0, 2.0, 4.0, 6.0, and 10.0 mL of working standard solution (25 μg/mL) to a series of five 50-mL volumetric flasks. (Masses are 25, 50, 100, 150, and 250 μg.) Dilute each flask to volume with deionized distilled water, and mix well.
6. Calibrate the conductivity detector according to manufacturer's specifications prior to initial use.

C. Analysis

1. Inject the calibration standards.
2. Inject samples and a blank, using same injection volumes as that of the standards.
3. Inject another set of calibration standards.
4. Repeat step C2 with a duplicate set of samples and blank.
5. Inject a final set of calibration standards.
6. Analyze the audit samples, if applicable.
7. Determine peak heights (if symmetrical) or, in all other cases, peak areas. Determine the averages.
8. Prepare or calculate a linear regression plot of the standards in μg (x-axis) versus their peak heights or areas. Determine the slope, and its reciprocal. If any point deviates from the line by more than 7% of the concentration, remake and reanalyze. **(See LDS 7A)**.
9. Perform all analyses on the same day. Dilute any sample and the blank with equal volumes of deionized distilled water if the concentration exceeds that of the highest standard.
10. Document each sample chromatogram by listing the following analytical parameters: injection point, injection volume, nitrate and sulfate retention times, flow rate, detector sensitivity setting, and recorder chart speed. **(See LDS 7A)**.

LABORATORY DATA SHEET 7A
Nitrogen Oxides

Client/Plant Name _____ Job # _____

Analyst _____ Date/Time _____

Note: Attach plot of calibration curve. Determine slope of curve and its reciprocal (S). Multiply S by by peak height or area and determine deviation of each point from the line. The deviation must be ≤7% of the concentration at each point.

Chromatographic Conditions: Eluent: _____ *(0.003M $NaHCO_3$/0.0024 M Na_2CO_3)?*

Detector Sensitivity _____ Injection Point _____ Injection Volume _____

Flow rate: _____ Chart Speed _____ Retention Times: Nitrate _____ Sulfate _____

Cal. Stds (mL)	(μg NO_2)	Initial Hgt/Area				Final Hgt/Area	Avg Hgt/Area
1.0	25						
2.0	50						
4.0	100						
6.0	150						
10.0	250						

Sample ID#	Volume Loss, V_l (mL)	Sample Volume, V_s (mL)	Peak Height/Area, H *(H_1/Avg ≤0.05?)*				NO_2 in Sample, m (μg)
			#1	#2	Avg	Blnk Corr, H_c	
Blank, B							
Audit Sample #1							
Audit Sample #2							

$H_c = H_{avg} - B_{avg}$ $m = H_c\ S\ F$ F = Dilution factor, only if sample is diluted to bring into calibration range.

QA/QC Check

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____ _____

Personnel (Signature/Date) Team Leader (Signature/Date)

SUMMARY SHEET 7B
Nitrogen Oxides

			Run #1	Run #2	Run #3	Avg
Client/Plant Name		FDS 7				
Job No.		FDS 7				
Sampling Location		FDS 7				
Run ID#		FDS 7				
Test Date		FDS 7				
Run Start Time		FDS 7				
Run Finish Time		FDS 7				
Traverse Points (if applicable)		FDS 7				
Initial Temperature, °F	t_i	FDS 7				
Initial Absolute Temperature, R	T_i	SS 7				
Final Temperature, °F	t_f	FDS 7				
Final Absolute Temperature, R	T_f	SS 7				
Initial Barometric Pressure, in. Hg	P_{bi}	FDS 7				
Initial Vacuum, in. Hg	P_{gi}	FDS 7				
Initial Absolute Pressure, in. Hg	P_i	SS 7				
Final Barometric Pressure, in. Hg	P_{bf}	FDS 7				
Final Vacuum, in. Hg	P_{gf}	FDS 7				
Final Absolute Pressure, in. Hg	P_f	SS 7				
Flask Volume, mL	V_f	CDS 7				
Volume Absorbing Reagent, mL	V_a	FDS 7				
Gas Sample Volume, mL	V_{sc}	SS 7				
Spectrophotometer Calibration Factor	K_c	LDS 7B				
Sample Solution Volume, mL		LDS 7B				
Average NO_2 Per Sample, μg	m	LDS 7B				
Sample Concentration, lb/dscf	C	SS 7B				
Audit Relative Error, %	RE	QA1				
Post-test Calibration Checks Temperature, Barometer, Vacuum Gauge		CDS 2d				

$$C = 6.242 \times 10^{-5} \frac{m}{V_{sc}}$$

LABORATORY PROCEDURE 7B
Nitrogen Oxides
(Ultraviolet Spectrophotometry)

Note: *This procedure is similar to that of Method 7, except for the following:*

A. Reagent Preparation

1. Working Standard KNO_3 Solution, 10 μg NO_2/mL. Dilute 10 mL of the standard solution to 1000 mL with deionized distilled water.
2. Quality Assurance Audit Samples. Obtain from EPA **(see QA 1)**.

B. Determination of Spectrophotometer Standard Curve

1. Add 0.0 mL, 5 mL, 10 mL, 15 mL, and 20 mL KNO_3 working standard solution to a series of five 100-mL volumetric flasks.
2. To each flask, add 5 mL absorbing solution. Dilute to the mark with deionized distilled water. The resulting solutions contain 0.0, 50, 100, 150, and 200 μg NO_2, respectively.
3. Measure the absorbance by ultraviolet spectrophotometry at 210 nm, using the blank as a zero reference.
4. Plot absorbance vs. μg NO_2. Calculate the spectrophotometer calibration factor. **(See LDS 7B)**.

C. Analysis

1. Pipette a 20-mL aliquot of sample into a 100-mL volumetric flask. If other than 20-mL is used, adjust standards and blank solutions accordingly.
2. Dilute to 100 mL with deionized distilled water.
3. Analyze the sample on the ultraviolet spectrophotometry at 210 nm, using the blank as zero reference.
4. With each set of compliance samples or once per analysis day, or once per week when averaging continuous samples, analyze each performance audit in the same manner as the sample to evaluate the analyst's technique and standard preparation. **(See QA 1)**.

LABORATORY DATA SHEET 7B
Nitrogen Oxides

Client/Plant Name _____ Job # _____

Analyst _____ Date/Time _____

Spectrophotometer ID# _____ Wavelength _____nm *(210 nm?)*

Date of Last Calibration _____ *(≤6 months?)*

$$K_c = 50 \frac{A_1 + 2A_2 + 3A_3 + 4A_4}{A_1^2 + A_2^2 + A_3^2 + A_4^2} = \_\_\_\_\_$$

Volume of Working Std (mL)	(A) Mass NO_2 in Std (μg NO_2)	(B) Absorbance (OD)	(C) K_c A_i (μg NO_2)
0.0	0	A_0	
5.0	50	A_1	
10.0	100	A_2	
15.0	150	A_3	
20.0	200	A_4	

Sample ID#	Volume Loss, V_l (mL)	Sample Volume, V_s (mL)	Aliquot Volume, V_a (mL)	Absorbance A (OD)	Mass/ Samp, m (μg NO_2)	Average m_{avg} (μg NO_2)
Audit Sample #1						
Audit Sample #2						

$m = 5 K_c A F$ 5 = 100/20 F = Dilution factor, if sample was diluted to bring absorbance into calibration range.

QA/QC Check

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____ _____

Personnel (Signature/Date) Team Leader (Signature/Date)

SUMMARY SHEET 7C
Nitrogen Oxides

			Run #1	Run #2	Run #3	Avg
Client/Plant Name		FDS 6/7C				
Job No.		FDS 6/7C				
Sampling Location		FDS 6/7C				
Run ID#		FDS 6/7C				
Test Date		FDS 6/7C				
Run Start Time		FDS 6/7C				
Run Finish Time		FDS 1				
Traverse Points (if applicable)						
Net Run Time, min	θ	FDS 6/7C				
Dry Gas Meter Calibration Factor	Y	FDS 6/7C				
Barometric Pressure, in. Hg	P_b	FDS 6/7C				
Average DGM Temperature, °F	t_m	FDS 6/7C				
Absolute Average DGM Temperature, R	T_m	FDS 6/7C				
Average CO_2, %	$\%CO_2$	FDS 7C				
Correction Factor for CO_2	X	SS 7C				
Volume of Metered Gas Sample, dcf	V_m	FDS 6/7C				
Volume of Metered Gas Sample, dscf	$V_{m(std)}$	SS 6				
Spectrophotometer Calibration Factor	K_c	LDS 7C				
Average NO_2 Per Sample, μg	m	LDS 7C				
Sample Concentration, lb/dscf	C	SS 7C				
Audit Relative Error, %	RE	QA1				
Post-test Calibration Checks						
Temperature and Barometer		CDS 2d				
Metering System		CDS 6				

$$X = \frac{100}{(100 - \%CO_2)}$$

$$V_{m(std)} = 17.64\ V_m\ X\ Y\ \frac{P_b}{T_m}$$

$$C = 6.242 \times 10^{-5}\ \frac{m}{V_{m(std)}}$$

FIELD PROCEDURE 7C
Nitrogen Oxides (Alkaline-Permanganate)

A. Pre-test Preparation

1. Prepare the collection train as follows:
   a. Add 200 mL $KMnO_4$/NaOH solution to each of three impingers.
   b. Assemble the train as shown in Figure F7C-1.
   c. Adjust probe heater to a temperature sufficient to prevent water condensation.
2. Determine the sampling point or points.
3. ***Optional:*** Leak-check the sampling train **(see FP 3c, sections C and D).**
4. ***Optional:*** Check of rotameter calibration accuracy as follows:
   a. Disconnect the probe from the first impinger, and connect the filter.
   b. Start the pump, and adjust the rotameter to read between 400 and 500 cc/min.
   c. After the flow rate has stabilized, measure the volume sampled from the DGM and the sampling time. Collect enough volume to measure accurately the flow rate, and calculate the flow rate (must be <500 cc/min for the sample to be valid).

B. Sampling

1. Record the initial DGM reading and barometric pressure. **Use FDS 6 and attach FDS 7C.**
2. Position the tip of the probe at the sampling point, connect the probe to the first impinger, and start the pump. Adjust the sample flow to between 400 and 500 cc/min.
3. Once adjusted, maintain a constant flow rate during the entire sampling run. Sample for 60 min.
4. Record the DGM temperature, and check the flow rate at least every 5 min.
5. At the conclusion of each run, turn off the pump, remove probe from the stack, and record the final readings.
6. Divide the sample volume by the sampling time to determine the average flow rate (must be <500 cc/min.
7. ***Mandatory:*** Leak-check the sampling train **(see FP 3c, sections C and D).**
8. During sampling, use Method 3 (Orsat or Fyrite) to measure CO_2 of the stack gas near the sampling point. If single-point grab sampling procedure is used, conduct measurements at least three times (near the start, midway, and before the end of a run), and the average CO_2 concentration.

C. Sample Recovery

1. Disconnect the impingers. Pour the contents of the impingers into a 1 L polyethylene bottle using a funnel and a stirring rod (or other means) to prevent spillage.
2. Rinse the impingers and connecting tubes with deionized distilled water until the rinsings are clear to light pink, and add the rinsings to the bottle.
3. Mix the sample, and mark the solution level. Seal and identify the sample container.

D. Post-test Calibrations

Conduct post-test calibrations of metering system and temperature gauges. **(See FP 2d and CP 6).**

E. Special Considerations

1. For relative accuracy (RA) testing of continuous emission monitors, the minimum sampling time is 1 hr, sampling 20 min at each traverse point.
2. For RA tests with SO_2 ≤ 1200 ppm, sample for 30 min (10 min at each point).

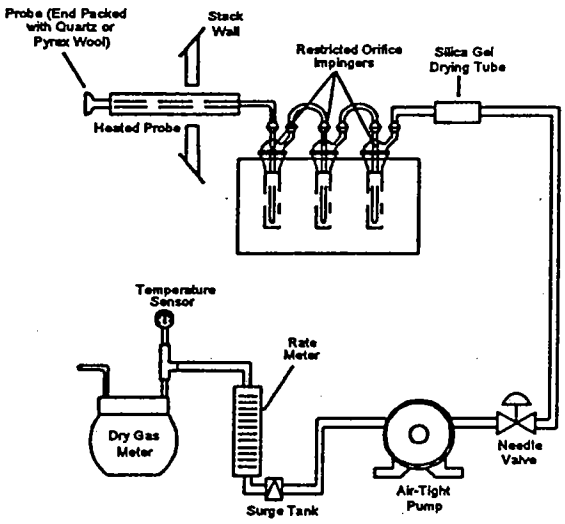

Figure F7C-1. NO_x Sampling Train.

FIELD DATA SHEET 7C
Nitrogen Oxides (Alkaline Permanganate)

Client/Plant Name _____ Job # _____

Test Location/Run # _____ Personnel _____

Use FDS 6 and attach this data sheet. For CO_2 (integrated sample), use FDS 3 and attach to FDS 6.

Continuation sheet of FDS 6 for FDS 7C

Trav. Pt.	Samplg time (min)	DGM Rdg (cf)	Rotameter Rdg (cc/min)	Temperature (°F)		Flow Rate Deviation	
				DGM	Imp. Exit	ΔV_m	$\Delta V_m/\Delta\overline{V}_m$
	Total Time, θ_s	Volume, V_m	Avg	Avg, t_m	Max ≤ 68°F?	Avg	0.90 - 1.10?

For Fyrite, single point analysis, fill in information in table.

Fyrite, Single Point Grab Sampling			
Run #	Clock Time		%CO_2
1	Beginning		
2	Midway		
3	Ending		
		Average:	

____ Flow Rate ≤500 cc/min?

If Relative Accuracy test of CEMS:

____ Sampling time of 1 hr, 20 min/point?

____ SO_2 ≥1200 ppm? Run for 30 min, 10 min/point.

QA/QC Check

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____ _____
Personnel (Signature/Date) Team Leader (Signature/Date)

LABORATORY PROCEDURE 7C
Nitrogen Oxides

A. Reagent Preparation

1. Potassium Permanganate, 4.0%, Sodium Hydroxide, 2.0%. Dissolve 40.0 g $KMnO_4$ and 20.0 g NaOH in 940 mL water.
2. Oxalic Acid Solution. Dissolve 48 g $(COOH)_2 \cdot 2H_2O$ in water, and dilute to 500 mL. Do not heat.
3. Sodium Hydroxide, 0.5 N. Dissolve 20 g NaOH in water, and dilute to 1 L.
4. Sodium Hydroxide, 10 N. Dissolve 40 g NaOH in water, and dilute to 100 mL.
5. Ethylenediamine Tetraacetic Acid (EDTA) Solution, 6.5%. Dissolve (using a magnetic stirrer) 6.5 g EDTA (disodium salt) in water, and dilute to 100 mL.
6. Column Rinse Solution. Add 20 mL 6.5% EDTA solution to 960 mL water, and adjust the pH to 11.7 to 12.0 with 0.5 N NaOH.
7. Hydrochloric Acid (HCl), 2 N. Add 86 mL conc. HCl to a 500-mL volumetric flask containing water, dilute to volume, and mix well. Store in a glass-stoppered bottle.
8. Sulfanilamide Solution. Add 20 g sulfanilamide (melting point 165 to 167°C) to 700 mL water. Add, with mixing, 50 mL conc. phosphoric acid (85%), and dilute to 1 L. Refrigerate. Do not use after 1 month.
9. N-(1-Naphthyl)-Ethylenediamine Dihydrochloride (NEDA) Solution. Dissolve 0.5 g NEDA in 500 mL water. Use only if this aqueous solution has an absorption peak at 320 nm over the range of 260 to 400 nm. Protect from sunlight and refrigerate. Do not use after 1 month.
10. Cadmium. See Matheson Coleman and Bell, 2909 Highland Avenue, Norwood, Ohio 45212, as EM Laboratories Catalogue No. 2001. Prepare (in an exhaust hood away from flame as H_2 is liberated) by rinsing in 2 N HCl for 5 min until the color is silver-grey. Then rinse the cadmium with water until the rinsings are neutral when tested with pH paper.
11. $NaNO_2$ Standard Solution, Nominal Concentration, 1000 μg NO_2^-/mL. Desiccate $NaNO_2$ overnight. Accurately weigh 1.4 to 1.6 g $NaNO_2$ (assay of 97% $NaNO_2$ or greater), dissolve in water, and dilute to 1 L. Calculate the exact NO_2^- concentration. Do not use after 6 months.
12. KNO_3 Standard Solution. Dry KNO_3 at 110°C for 2 hr, and cool in a desiccator. Accurately weigh 9 to 10 g KNO_3 to within 0.1 mg, dissolve in water, and dilute to 1 L. Calculate the exact NO_3^- concentration. Do not use after 2 months.
13. Spiking Solution. Pipette 7 mL KNO_3 standard into a 100-mL volumetric flask, and dilute to volume.
14. Blank Solution. Dissolve 2.4 g $KMnO_4$ and 1.2 g NaOH in 96 mL water. Alternatively, dilute 60 mL $KMnO_4$/NaOH solution to 100 mL.
15. Quality Assurance Audit Samples. Obtain from EPA **(see QA 1)**.

B. Calibration Curve for Spectrophotometer

1. Dilute 5.0 mL $NaNO_2$ standard solution to 200 mL with water to obtain nominally 25 μg NO_2^-/mL. Using pipettes, prepare at least three calibration standards each for the linear and slightly nonlinear curve to cover the range of 0.25 to 3.00 μg NO_2^-/mL.
2. Analyze the standards and a water blank.
3. Plot the net absorbance vs. μg NO_2^-/mL. Draw a smooth curve through the points and the origin. The curve should be linear from zero up to an absorbance of about 1.2 with a slope of about 0.53 absorbance units/μg NO_2^-/mL. The curve is slightly nonlinear from an absorbance of 1.2 to 1.6.

C. Sample Preparation

1. Prepare a cadmium reduction column as follows:
   a. Fill the burette with water. Add freshly prepared cadmium slowly with tapping until no further settling occurs. Final height of the cadmium column should be 39 cm. Do not use cadmium (e.g., regenerated) that causes a band of cadmium fines.
   b. When not in use, store the column under rinse solution (A6).
2. Note the level of liquid in the sample container, and determine loss; note this loss, if any, on the laboratory data sheet.
3. Quantitatively transfer the contents to a 1 L volumetric flask, and dilute to volume.
4. Take a 100-mL aliquot of the sample and blank (unexposed $KMnO_4$/NaOH) solutions, and transfer to 400-mL beakers containing magnetic stirring bars.
5. Using a pH meter, add conc. H_2SO_4 with stirring until a pH of 0.7 is obtained.

6. Allow the solutions to stand for 15 min.
7. Cover the beakers with watch glasses, and bring the temperature of the solutions to 50°C. Keep <60°C.
8. Dissolve 4.8 g oxalic acid in a minimum (about 50 mL) volume of water at room temperature. Do not heat the solution.
9. Slowly add oxalic acid solution to the $KMnO_4$ until it becomes colorless. If the color is not completely removed, prepare more of the oxalic acid solution, and add until a colorless solution is obtained.
10. Add an excess of oxalic acid by dissolving 1.6 g oxalic acid in 50 mL water, and add 6 mL to the colorless solution.
11. If suspended matter is present, add conc. H_2SO_4 until a clear solution is obtained.
12. Allow samples to cool to room temperature, and ensure samples remain clear.
13. Adjust the pH to 11.7 to 12.0 with 10 N NaOH.
14. Quantitatively transfer the mixture to a Buchner funnel containing GF/C filter paper, and filter the precipitate. Filter the mixture into a 500-mL filtering flask. Wash the solid material four times with water.
15. When filtration is complete, wash the Teflon tubing, transfer the filtrate to a 500-mL volumetric flask, and dilute to volume. The samples are now ready for cadmium reduction.
16. Pipette a 50-mL aliquot of the sample into a 150-mL beaker, and add a magnetic stirring bar.
17. Pipette in 1.0 mL 6.5% EDTA solution, and mix.
18. Set stopcock to establish a flow rate of 7 to 9 mL/min of column rinse solution through the cadmium reduction column. Use a 50-mL graduated cylinder to collect and measure the solution volume.
19. After the last of the rinse solution has passed from the funnel into the burette, but before air entrapment can occur, add sample, and collect it in a 250-mL graduated cylinder.
20. Complete the quantitative transfer of the sample to the column as the sample passes through the column. After the last of the sample has passed from the funnel into the burette, start adding 60 mL column rinse solution, and collect the rinse solution until the solution just disappears from the funnel.
21. Quantitatively transfer the sample to a 200-mL volumetric flask (250-mL may be required), and dilute to volume. The samples and blank are now ready for NO_2^- analysis.
22. Run two spiked samples with every group of samples passed through the column.
    a. Prepare spiked samples by taking 50-mL aliquots of the sample suspected to have the highest NO_2^- concentration, and adding 1 mL spiking solution.
    b. Calculate spike recovery and column efficiency. If either is <95%, prepare a new column, and repeat the cadmium reduction.

D. Analysis

1. Pipette 10 mL sample into a culture tube. Do not use test tubes, unless it has a low blank NO_2^- value.
2. Pipette in 10 mL sulfanilamide solution and 1.4 mL NEDA solution.
3. Cover the culture tube with parafilm, and mix the solution.
4. Prepare a blank in the same manner using the sample from treatment of the unexposed $KMnO_4$/NaOH solution (A1).
5. Prepare a calibration standard to check the slope of the calibration curve.
6. After a 10-min color development interval, measure the absorbance at 540 nm against water.
7. Read μg NO_2^-/mL from the calibration curve. If the absorbance is greater than that of the highest calibration standard, pipette less than 10 mL, and repeat the analysis.
8. Determine the NO_2^- concentration using the calibration curve obtained in B3.
9. Analyze the audit samples, if applicable.

LABORATORY DATA SHEET 7C
Nitrogen Oxides

Client/Plant Name _____ Job # _____

Analyst _____ Date/Time _____

Spectrophotometer ID# _____ Wavelength _____ nm

Date of Last Calibration _____ *(≤6 months?)*

Volume of Working Std (mL)	(A) Mass NO_2 in Std (μg NO_2)	(B) Absorbance (OD)	(C) K_c A_i (μg NO_2)	(C) - (A) (μg NO_2)	QC Chk (μg NO_2)
		A_1			
		A_2			
		A_3			

Sample ID#	Volume Loss, V_l (mL)	Sample Volume, V_s (mL)	Aliquot Volume, V_a (mL)	Absorbance A (OD)	NO_2 Analyzed, S (μg)	NO_2 in Samp, m (μg)
Blank						
Spiked Sample #1						
Spiked Sample #2						
Audit Sample #1						
Audit Sample #2						

$E = \frac{(\text{Spiked} - \text{Unspiked})}{\text{Spike Conc}}$ $m = \frac{(S - B)}{E}$

S = Sample
B = Blank
E = Column Efficiency ***(must be ≥95%)***

QA/QC Check

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____ _____

Personnel (Signature/Date) Team Leader (Signature/Date)

SUMMARY SHEET 7D
Nitrogen Oxides

			Run #1	Run #2	Run #3	Avg
Client/Plant Name		FDS 6/7C				
Job No.		FDS 6/7C				
Sampling Location		FDS 6/7C				
Run ID#		FDS 6/7C				
Test Date		FDS 6/7C				
Run Start Time		FDS 6/7C				
Run Finish Time		FDS 1				
Traverse Points (if applicable)						
Net Run Time, min	θ	FDS 6/7C				
Dry Gas Meter Calibration Factor	Y	FDS 6/7C				
Barometric Pressure, in. Hg	P_b	FDS 6/7C				
Average DGM Temperature, °F	t_m	FDS 6/7C				
Absolute Average DGM Temperature, R	T_m	FDS 6/7C				
Average CO_2, %	$\%CO_2$	FDS 7C				
Correction Factor for CO_2	X	SS 7C				
Volume of Metered Gas Sample, dcf	V_m	FDS 6/7C				
Volume of Metered Gas Sample, dscf	$V_{m(std)}$	SS 7C				
Average NO_2 Per Sample, μg	m	LDS 7D				
Sample Concentration, lb/dscf	C	SS 7D				
Audit Relative Error, %	RE	QA1				
Post-test Calibration Checks						
Temperature and Barometer		CDS 2d				
Metering System		CDS 6				

$$C = 6.242 \times 10^{-5} \frac{m}{V_{m(std)}}$$

LABORATORY PROCEDURE 7D
Nitrogen Oxide

A. Reagent Preparation

1. The following are the same as that in LP 7C:
   a. Potassium Permanganate, 4.0%, Sodium Hydroxide, 2.0% (A1).
   b. Standard Potassium Nitrate (A12).
   c. Blank Solution (A14).
2. Hydrogen Peroxide, 5%. Dilute 30% H_2O_2 1:5 (v/v) with water.
3. Eluent, 0.003 M $NaHCO_3$/0.0024 M Na_2CO_3. Dissolve 1.008 g $NaHCO_3$ and 1.018 g Na_2CO_3 in water, and dilute to 4 L. Other eluents capable of resolving nitrate ion from sulfate and other species present may be used.
4. Quality Assurance Audit Samples. Obtain from EPA **(see QA 1).**

B. Calibration Curve for Ion Chromatograph.

1. Dilute a given volume (1.0 mL or greater) of the KNO_3 standard solution to a known volume with water.
2. With the KNO_3 solution prepare at least four standards to cover the range of the samples being analyzed. Use pipettes for all additions.
3. Prepare the chromatograph and set the conditions to operate properly.
4. Analyze standards according to section D.
5. Determine peak height or area, and plot the individual values versus concentration in μg NO_3^-/mL. Do not force the curve through zero. Draw a smooth curve through the points. Use linear regression to determine the calibration equation.

C. Sample Preparation

1. Note the level of liquid in the sample container, and determine loss; note this loss, if any, on the laboratory data sheet.
2. Quantitatively transfer the contents to a 1 L volumetric flask, and dilute to volume.
3. Prepare samples 36 hr after collection to ensure that all NO_2^- is converted to NO_3^-.
4. Take a 50-mL aliquot of the sample and blank, and transfer to 250-mL Erlenmeyer flasks. Add a magnetic stirring bar. Stir as fast as possible without loss of solution.
5. Using a 5-mL pipette, add 5% H_2O_2.
6. When the $KMnO_4$ color appears to have been removed, allow the precipitate to settle, and examine the supernatant liquid. If the $KMnO_4$ color persists, add more H_2O_2, with stirring, until the supernatant liquid is clear. The faster the stirring rate, the less volume of H_2O_2 required to remove the $KMnO_4$.
7. Quantitatively transfer the mixture to a Buchner funnel containing GF/C filter paper, and filter. Filter the mixture into a 500 mL filtering flask. Wash the solid material four times with water.
8. When filtration is complete, wash the Teflon tubing, quantitatively transfer the filtrate to a 250-mL volumetric flask, and dilute to volume. Analyze the samples and blank.

D. Analysis

1. Establish a stable baseline.
2. Inject a sample of water, and determine whether any NO_3^- appears in the chromatogram.
3. If NO_3^- is present, repeat the water load/injection procedure approximately five times; then re-inject a water sample, and observe the chromatogram.
4. When no NO_3^- is present, the instrument is ready for use.
5. Inject calibration standards.
6. Inject samples and a blank.
7. Repeat the calibration standards injection (to compensate for any drift in response of the instrument).
8. Measure the NO_3^- peak height or peak area, and determine the sample concentration from the calibration curve.
9. Analyze the audit samples, if applicable.

LABORATORY DATA SHEET 7D
Nitrogen Oxides

Client/Plant Name _____ Job # _____

Analyst _____ Date/Time _____

Water/NO_3^- Check (OK?) _____

Chromatographic Conditions: Eluent: _____ *(0.003M $NaHCO_3$/0.0024 M Na_2CO_3)?*

Full scale range: _____ *(3 µMHO)?* Sample loop: _____ *(0.5 mL)?*

Flow rate: _____ *(2.5 mL/min)?* Retention time: _____ *(approx. 15 min)?*

Cal. Stds (µg/NO_3^-)	Initial						Final

Sample ID#	Volume Loss, V_l (mL)	Sample Volume, V_s (mL)	Aliquot Volume, V_a (mL)	Peak Height/Area	NO_2 Analyzed, S (µg)	NO_2 in Sample, m (µg)
Blank, B						
Audit Sample #1						
Audit Sample #2						

m = 3710 ((S - B) B = Blank

QA/QC Check

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____ _____

Personnel (Signature/Date) Team Leader (Signature/Date)

FIELD PROCEDURE 7E
Nitrogen Oxides
(Instrumental Analyzer Procedure)

Note: *The procedure for FP 7E is essentially the same as that for FP 6C, except for the obvious differences due to the gases being analyzed and the detection device.* ***The analyzer must be based on the principles of chemiluminescence.*** *Follow FP 6C, except for the following:*

1. Obtain calibration gases (NO in N_2). Ambient air may be used for the zero gas.
2. For non-Protocol 1 calibration gases, Method 7 is the reference method and the acceptance criterion is ±10% or 10 ppm, whichever is greater. **See CDS 6Ca.**
3. Initially and whenever changes are made in the instrumentation that could alter the interference response (e.g., changes in the gas detector), conduct the interference response test according to FP 20, step B3.
4. If the NO_2 concentration within the sample stream is >5% of the NO_x concentration, conduct an NO_2 to NO conversion efficiency test according to FP 20, step B5.
5. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 7.
6. Run for the same sampling duration per run as that used for Method 7 plus twice the stable response time for the instrument.

LABORATORY DATA SHEET 7E
Interference Response

Date _____ Personnel _____

Analyzer Type _____ Analyzer ID# _____

Test Gas	Nominal Concentration	Actual Concentration	Analyzer Response	% of Span
Method 20			***Span Value:***	
CO	500 ± 50 ppm			
SO_2	200 ± 20 ppm			
CO_2	10 ± 1 %			
O_2	20.9 ± 1%			
Method:			***Span Value:***	

$$\% \text{ of Span} = \frac{\text{Analyzer Response}}{\text{Instrument Span}} \times 100$$

____ Sum of the interference responses to the test gas for either the NO_x or diluent analyzer <2% of span value?

NO_2-NO Converter Efficiency

Peak response recorded during test _____

Response recorded at end of 30 minutes _____ (Attach strip chart or recorder readout)

% Decrease from peak response _____ (≤2%?)

QA/QC Check

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Checked by: _____ _____

Personnel (Signature/Date) Team Leader (Signature/Date)