

Source Test Method **ST-16**

PHENOLIC COMPOUNDS

(Adopted January 20, 1982)

REF: Regulation 7-303

1. APPLICABILITY

1.1 This method is used to quantify emissions of phenolic compounds as phenol. It is applicable to the determination of compliance with Regulation 7-303.

2. PRINCIPLE

2.1 Sample gas is drawn through a solution of 0.1 normal (0.1N) sodium hydroxide which absorbs the phenolic compounds. The phenolic compounds are then analyzed by gas chromatography as specified in Analytical Procedure Lab-8.

3. RANGE AND SENSITIVITY

3.1 The minimum measurable concentration of phenolic compounds is 200 ppb at the sample volume specified in this procedure.

3.2 Elevated concentrations of phenolic compounds may be determined by increasing the concentration of the absorbing reagent, sodium hydroxide solution. The concentration of reagent to be used may be determined by stoichiometry, allowing a 50% excess.

4. INTERFERENCE

None Known.

5. APPARATUS

5.1 Probe. The probe is constructed of borosilicate glass tubing fitted with glass wool in the nozzle.

5.2 Absorbers. Use three Greenberg-Smith impingers. The third impinger has a thermometer attached to the inlet stem.

5.3 Cooling System. An ice bath is used to contain the impingers.

5.4 Sample Pump. Use a leak-free vacuum pump capable of maintaining a 0.5 CFM flow rate at 15 inches of mercury-vacuum. The pump has a flow control valve and vacuum gauge attached to the inlet.

5.5 Silica Gel Tube. Approximately 500cc of silica gel with a Drierite indicator are used to insure that the gas entering the dry gas meter is dry.

- 5.6 Dry Test Meter. Use a 175 CFH dry gas test meter accurate within $\pm 2\%$ of the true volume and equipped with a thermometer to measure the outlet temperature.
- 5.7 Connections. Use Teflon tubing in making all connections that come in contact with the sample. Vinyl tubing is acceptable for all other connections.
- 5.8 Barometer. Use a mercury, aneroid, or other barometer that is accurate to within ± 0.2 inches of mercury.
- 5.9 Rotameter. Use a calibrated Rotameter to measure the sampling rate.

6. REAGENTS

- 6.1 0.1N Sodium Hydroxide Acid. Dissolve 4.0 grams of NaOH in sufficient distilled water to make a 1.0 liter solution.

7. PRE-TEST PROCEDURES

- 7.1 Add 100 ml of the 0.1N NaOH solution to each of the two impingers.
- 7.2 Stopper the impingers.
- 7.3 Retain 100ml of the solution to later analyze as a blank for phenol compounds.
- 7.4 Assemble the sampling train as shown in Figure 16-1. Record the equipment identification on the test data sheet Form 16-1.
- 7.5 Leak-test the sampling train by turning on the pump, plugging the probe, adjusting the pump inlet vacuum to 10 inches Hg. The leak rate must not exceed 0.02 CFM through the dry test meter. Before turning off the pump, carefully release the plug in the sample probe to avoid backflow of the impinger solution.
- 7.6 Record the initial dry test meter reading and barometric pressure using Form 16-1.

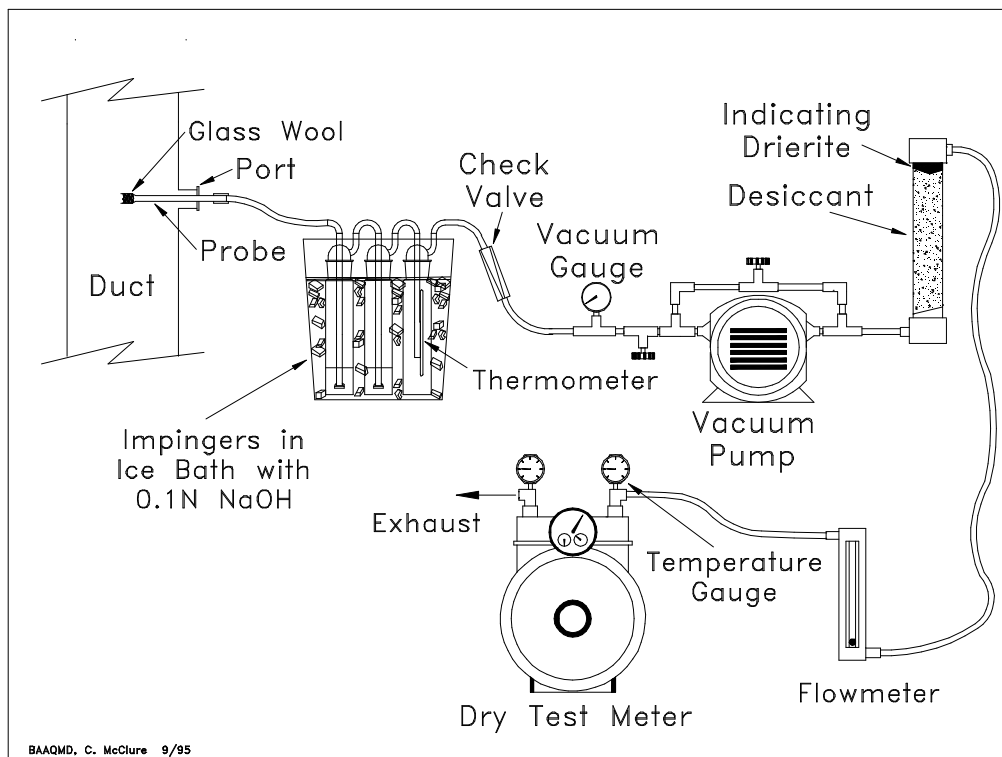
8. SAMPLING

- 8.1 Sample at continuous operations for a period of thirty minutes for each test run. Sample at batch processes for a period of thirty minutes or 90% of the batch process time, whichever is less.
- 8.2 Position the probe at the sampling point and start the pump.
- 8.3 Sample at a constant rate of 14.3 liter/min (0.5 CFM) during the test as determined by the rotameter.
- 8.4 Record the following information at five-minute intervals:
 - dry test meter temperature
 - impinger outlet temperature
 - dry test meter volume
 - rotameter flow
- 8.5 Add ice as necessary to maintain impinger temperatures at 7 °C (45°F) or less.

- 8.6 At the conclusion of each run, stop the pump, remove the probe from the stack, and record the final meter volume.
- 8.7 Take three consecutive samples.

Figure 16-1

Phenolic Compound Sampling Train



9. POST-TEST PROCEDURES

- 9.1 Stopper the impingers until they are analyzed.
- 9.2 Individually analyze the sodium hydroxide solutions and blank for total content of phenolic compounds, as phenols, according to Analytical Procedure Lab-8.

10. CALCULATIONS

- 10.1 Standard sample volume:

$$V_o = \frac{17.71V_m P_b}{T_m}$$

Where:

- V_o = Corrected sample volume, SDCF at 70°F and 29.92 inches Hg
- V_m = Uncorrected meter volume, ft³

- T_m = Average run meter temperature, °R
 P_b = Barometric pressure, inches Hg
17.71 = A constant correcting to 70°F and 29.92 inches Hg

10.2 Phenolic compound, as phenol concentration:

$$C = \frac{9.07 \times 10^3 W}{V_o}$$

Where:

- C = Phenolic compound, as phenol concentration, ppm by volume on a dry basis
 W = Total weight of phenolic compounds, as phenol in the impinger catch, for each run, grams.
 9.07×10^{-3} = Constant derived from molar volume, 453.6 grams/lb and molecular weight of phenol

11. REPORTING

11.1 Report the data indicated on Form 16-2.

Bay Area Air Quality Management District

939 Ellis Street, San Francisco, CA 94109

Form 16-1 Source Test Data Sheet

Plant # _____
 Source I.D. _____
 Sample Type _____
 Process Cycle _____
 Duct Size _____
 Duct Shape _____
 Duct Pressure _____
 Assumed %H₂O _____

Run # _____
 Temp Meter # _____
 Mag. Gauge # _____

Date: _____
 Box ΔH@ _____
 Meter (Y) _____

_____ Nozzle Diameter
 _____ Pitot Tube I.D., Cp
 _____ Gas System
 _____ Pbar, Barometer
 _____ Leak Test Rate
 _____ Time @ Point
 _____ # of Points
 _____ Time/Run (Min.)

Sampling Train: Probe # _____ Filter # _____ Imp. # _____ Imp. # _____ Pump/Box # _____

Initial Traverse Data					Sampling Data									
Trav. Point I.D.	Dist. from Wall	Duct Temp. °F	ΔP "H ₂ O	Angle of Flow	Traverse Point I.D.	ΔP "H ₂ O	Duct Temp. °F	Vs FPS	Time (minutes)	Meter Rate CFH	Meter Temp. °F	Meter Volume Ft ³	Train Vacuum "Hg	Sat'd Gas Temp. °F

Post Run Impinger Catch (ml) = _____
 Assumed O₂ = _____
 Assumed CO₂ = _____
 Post Run Calculated %H₂O = _____

Source Test Team

Comments: _____

Form 16-2

Distribution: Firm Permit Services Enforcement Services Technical Services Planning Requester DAPCO	BAY AREA AIR QUALITY MANAGEMENT DISTRICT <i>939 Ellis Street San Francisco, California 94109 (415) 771-6000</i> Summary of Source Test Results	Report No.: _____ Test Date: _____ Test Times: Run A: _____ Run B: _____ Run C: _____
Source Information		BAAQMD Representatives
Firm Name and Address	Firm Representative and Title Phone No. ()	Source Test Engineers
Permit Conditions:	Source: Plant No. Permit No. Operates	Permit Services Division/Enforcement Division Test Requested By:
Operating Parameters:		
Applicable Regulations:		VN Recommended:

Source Test Results and Comments:

<u>METHOD</u> <u>TEST</u>	<u>RUN A</u>	<u>RUN B</u>	<u>RUN C</u>	<u>AVERAGE</u>	<u>LIMIT</u>
Stack Gas Temperature, °F					
ST-16 Total Phenols, as C ₆ H ₅ OH, ppmv					

Air Quality Engineer II	Date	Supervising Air Quality Engineer	Date	Approved by Air Quality Engineering Manager
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