

**MANUAL OF PROCEDURES**  
**VOLUME VI**  
**AIR MONITORING PROCEDURES**  
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**APPENDIX A - METEOROLOGICAL MONITORING GUIDANCE FOR  
MANUAL OF PROCEDURES**

# 1. GROUND LEVEL MONITORING FOR SULFUR DIOXIDE AND HYDROGEN SULFIDE

REF: Regs. 1-510, 1-600  
9-1-501, 9-1-604  
9-2-501, 9-2-601

- 1.1 General.** This section outlines the procedures to be used for atmospheric sampling of ground level hydrogen sulfide (H<sub>2</sub>S) and sulfur dioxide (SO<sub>2</sub>) concentrations in order to fulfill the requirements of Regulation 1 - 510.
- 1.2 Instrumentation.** When required under Regulation 9-1-501 or Regulation 9-2-501, the person responsible for emissions shall provide recording instrumentation at not less than three sites chosen to monitor the ambient air in the area surrounding the emission source and at least one meteorological station to record wind speed and direction. Additional instruments may be required in specific cases where necessary to meet the intent of the appropriate section. The instruments shall be sufficient in number to give reasonable assurance that any ground level limits exceeding the applicable standards will be detected. All analytical instrumentation shall be capable of detecting ground level concentrations which exceed the allowable limits. All instrumentation shall be continuous and equipped with either a strip chart recorder or an electronic data recorder which archives data at averaging intervals not to exceed one minute. Hydrogen sulfide and sulfur dioxide instruments shall be equipped with a strip chart recorder that operates continuously.
- 1.2.1 Sulfur Dioxide Instrument Specifications.** The instruments shall be of a type which will continuously detect and record minute-by-minute fluctuations of concentrations of sulfur dioxide in the range from 0.01 ppm (vol) to 1.00 ppm (vol).
- 1.2.2 Hydrogen Sulfide Instrument Specifications.** The recording instruments shall be of a type which will continuously detect and record minute-by-minute fluctuations of concentrations of H<sub>2</sub>S in the range from 0.01 ppm (vol) to 0.10 ppm (vol), or to 0.20 ppm (vol).
- 1.2.3 Meteorological Instrument Specifications.** Meteorological instruments shall be capable of continuously measuring and recording wind direction and wind speed to comply with the latest edition of the Bay Area Air Quality Management District Meteorological Monitoring Guidance (Appendix A to this manual).

- 1.3 Siting.** The instruments shall be installed and operated in locations which adequately represent maximum ground level concentrations of the measured air pollutants. Sites will be chosen to intercept most frequent ground level maximum concentrations, but in conformance with Regulation 1-510. Proper siting will be taken to require that a preponderant downwind exposure over the calendar year be accumulated by the instruments of given network, during their hours of operation. Downwind exposure exists when the mean wind direction lies in the arc within 22.5 degrees of a direct line from source to monitor. The effective source height and the prevalent stability class associated with the most frequent wind directions are used to calculate the most probable distances for maximum ground level concentrations. A station may be placed at or within the property line if the location is otherwise acceptable and provided that the person responsible for the stations agrees in writing that such location shall, for the purposes of District requirements, be deemed to be off the property from which the emissions occur.

The wind measuring site (or sites) shall be located within the general area encompassed by the source and the ground level monitors. In any case, they must comply with the latest edition of the Bay Area Air Quality Management District Meteorological Monitoring Guidance. Final approval of the siting of ground level monitors and meteorological instrumentation shall be with the APCO.

- 1.4 Maintenance.** Regulation 1-510 requires that the person responsible for monitoring provide care and maintenance in order to assure that the instruments function properly and accurately measure ground level concentrations. A record of consistent instrument downtime may be considered failure to meet this requirement. The APCO may require submission of maintenance records.
- 1.5 Calibration.** Regulation 1-510 requires that the person responsible for monitoring perform periodic calibrations to assure that the instruments provide acceptable monitoring of ground level concentrations. Additionally, a field calibration shall be performed after any relocation of an analyzer or major repair work. For sulfur dioxide the reference method for calibration is specified in Section 1.5.6 of this volume; for hydrogen sulfide, in Section 1.5.8.

As a quality assurance measure, District personnel will periodically inspect sites, and may perform calibration audits on the ground level monitors to determine accuracy. Accuracy of a calibration is expressed as the deviation between the analyzer response obtained under test conditions and the results of the reference procedure when samples of the same test gas are taken at approximately the same time. Deviation is calculated as a percent of the reference results.

$$\% \text{ Deviation} = \frac{\text{Analyzer Value} - \text{Reference Value}}{\text{Reference Value}} \times 100$$

The acceptable limit for sulfur dioxide analyzer calibrations is  $\pm 10\%$  deviation. The acceptable limit for hydrogen sulfide analyzer calibrations is  $\pm 15\%$  deviation.

A record of unacceptable calibrations will be considered failure to meet the requirement. The APCO may require submission of calibration records.

**1.5.1 Dynamic Calibration Procedure.** A dynamic calibration is a performance test of the entire analyzer system under simulated operating conditions. The analyzer system includes the analyzer, recorder and/or data transmission system, and the sampling system with its sample lines and sample filters.

The procedure is to allow the analyzer system to sample a zero air to establish an analyzer zero response (baseline) and to sample test-gas mixtures of known concentration from a calibration gas system (See Fig. 1) to establish an upscale response. A test-gas mixture with concentration approximately equal to midscale of the analyzer range should be used. The reference methods Sulfur Dioxide Analytical Procedure 1.5.6, Hydrogen Sulfide Analytical Procedure 1.5.7 contained in this volume are used to verify test-gas concentrations.

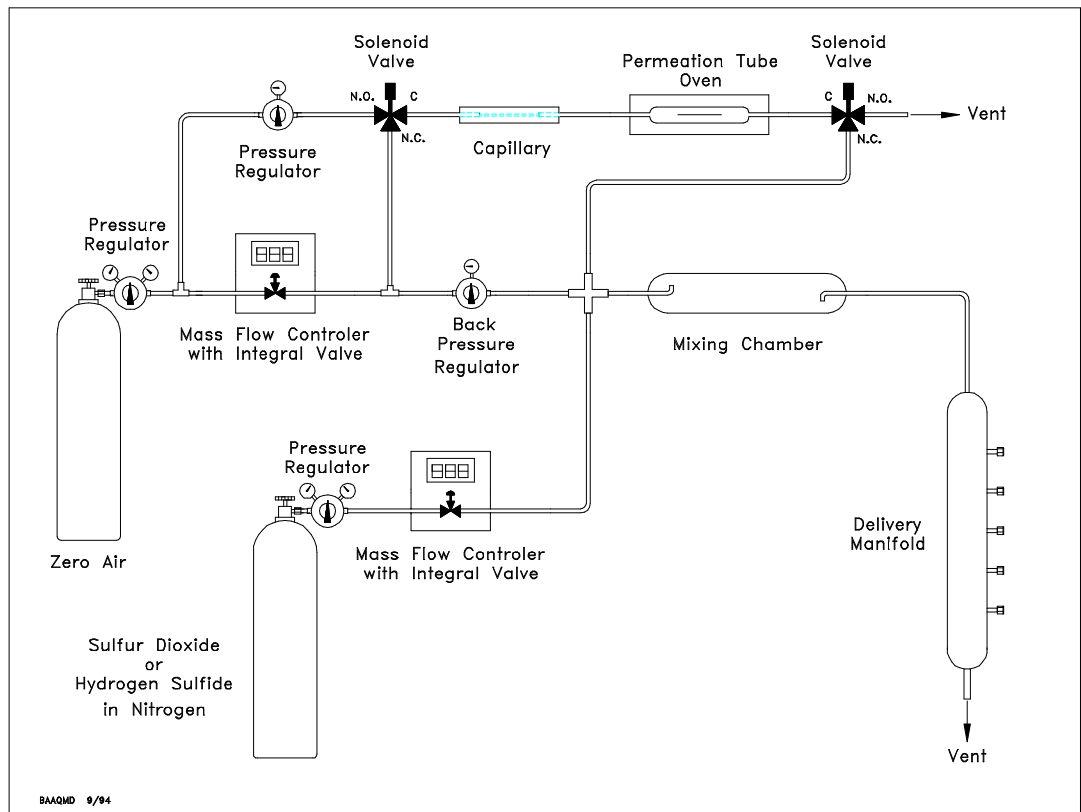
The test-gas concentration and the analyzer response are used in the formula in Calibration 1.5 to determine the percent deviation. The analyzer response is the net reading derived by subtracting the zero response (baseline) from response to the test gas. The analyzer should be corrected to make its response conform to the known test-gas concentration. After adjustments are made, it is necessary to repeat the sampling process to reestablish both the zero and upscale analyzer responses. Linearity and low level response are determined by varying the diluent air calibration gas ratios to provide test gas concentrations throughout the entire range of the analyzer.

**1.5.2 Zero (Diluent) Air.** Zero air is used to establish a baseline point of reference and as a diluent in preparation of test gas mixtures. This air must be free of any substances which can alter the test gas mixtures or can affect the analyzer response or the reference method. The presence of ambient Carbon Dioxide (CO<sub>2</sub>) levels in the test gas mixture is necessary for calibration of flame photometric analyzers.

**1.5.3 Calibration Gas System.** A calibration gas system consists of a source of diluent air, a source of calibration gas, a mixing chamber and a delivery manifold from which analyzers and reference sampling trains can sample the test gas. The test gas is prepared by thoroughly mixing the calibration gas and diluent air in various known proportions. The calibration gas can be obtained from a permeation device or from a pressurized cylinder containing a suitable concentration of the calibration gas.

The calibration gas system should be positioned as closed as is practical to the analyzer and reference sampling apparatus to minimize losses. Sample lines, flow metering devices, mixing chambers, all other parts of the calibration system, as well as the analyzer system should be of materials which will not affect the test gas concentration. All components used in the calibration procedure should be allowed sufficient time to stabilize before reference samples are taken and before analyzer response is determined.

**Figure 1 - Calibration Gas System**



**Pressurized Gas Standards** Gas standards in pressurized cylinders can be used as a gas source to be diluted in a calibration gas system or used directly when the concentration is within the operating range of the analyzer. Cylinders can be prepared in the laboratory or obtained commercially in various concentrations with or without analysis based on reference methods. Such gas standards should be restandardized against the reference method at a minimum of once every six months. Reference samples must be taken each time if a nonstandardized gas source is used in the performance of an instrument calibration.

**Permeation Device** A permeation device, based on the diffusion of a gas through a semi-permeable membrane, can be used as a gas source in a calibration gas system. The diffusion rate is a function of temperature and therefore constant temperature must be maintained throughout the calibration. Permeation devices are available commercially with or without analysis based on the reference method. Certified permeation devices should be standardized gravimetrically or against the accepted reference method at a minimum of once every six months. Reference samples must be taken each time if a nonstandardized permeation device is used.

Precautions to be taken with permeation devices include:

- a. Storage of the device in a dry nitrogen atmosphere, preferably between 20 to 25°C.
- b. Use of a dry, analyte-free carrier gas.
- c. Handling of a permeation device only in a well vented atmosphere.
- d. Allowance of a minimum of 24 hours for a permeation device to establish temperature equilibrium before use.

#### 1.5.4 Calculations.

##### a. Conversion Factors

$$\frac{\mu\text{g SO}_2}{2.6 \mu\text{g}/\mu\text{l}} = \mu\text{l SO}_2$$

$$\frac{\mu\text{g } _2\text{S}}{1.4 \mu\text{g}/\mu\text{l}} = \mu\text{l H}_2\text{S}$$

- b. To calculate parts per million concentration from the known emission rate of a permeation device, use the following equation:

$$\text{PPM} = \frac{P}{Qd}$$

Where: P = Permeation rate in  $\mu\text{l}/\text{minute}$   
 Qd = Rate of diluent in liters/minute

- c. To calculate parts per million concentration when using a pressurized gas standard, use the following equation:

$$\text{PPM} = \frac{F_1 \times c}{F_1 + F_0}$$

Where: F<sub>0</sub> = Diluent air flow in ml/minute  
 F<sub>1</sub> = Calibration gas flow in ml/minute  
 c = Concentration of calibration gas in ppm

- 1.5.5 Calibration Records.** Calibration records shall be maintained containing the information necessary to determine test gas concentrations and to determine the percent deviation of an analyzer's response to known test-gas concentrations.

#### **1.5.6 Sulfur Dioxide Reference Procedure**

##### **Principle.**

The method is based on the absorption of sulfur dioxide contained in a dilute calibration stream by a solution of sodium tetrachloromercurate (TCM). A stable complex is formed, which is then reacted with formaldehyde pararosaniline resulting is a colored pararosaniline derivative. The optical density, spectrophotometrically, is proportional to the amount of sulfur dioxide initially absorbed.

##### **Reagents.**

- 1. Absorbing Solution (TCM)** Dissolve 27.2 g of mercuric chloride and 11.7 g of sodium chloride in distilled water and dilute to 1 liter. The absorbing reagent is stable for 6 months.
- 2. Pararosaniline Hydrochloride Solution.** Dissolve 0.15 g of pararosaniline in 1 liter of distilled water containing 81 ml of concentrated hydrochloric acid. Mix well and allow to stand for two days before using. A new standard curve should be prepared for each new batch. This reagent is stable for 6 months.
- 3. Formaldehyde Solution 0.2%.** Dilute 0.5 ml of 37% formaldehyde solution to 100 ml with distilled water. This solution should be prepared prior to us.



### Apparatus

1. Midget impingers, such as Ace Glass Inc., Cat. No. 7531.
2. Air pump with flow control and with a minimum capacity of 2 liters per minute through a midget impinger.
3. Spectrophotometer, suitable for measurement at  $560 \pm 25$  nm.
4. Flowmeter, 0 to 2 liter per minute range.
5. Stopwatch.

### Sample Collection

1. Preset the air pump to a flowrate of approximately 1 liter per minute. Prepare the sampling train by connecting the flowmeter to the sample manifold (Fig. 1, 1.5.3).
2. Pipet 10.0 ml of absorbing solution into a midget impinger. Connect the impinger to the flowmeter, and attach the air pump to the exit tube of the impinger.
3. When the calibration stream is stable and at the desired concentration level, start the air pump and the stopwatch. Immediately make the minor adjustment for a desired flow rate of 1.0 liter/min and maintain flow for a time interval sufficient to collect from 5 to 13  $\mu\text{g}$  of  $\text{SO}_2$ . For stream concentrations approaching or greater than 1.0 ppm, a flow rate of 0.5 liter per minute may be used.
4. Take at least two samples for each calibration point.

### Analysis

1. To the contents of each impinger add 1.0 ml of 0.2% formaldehyde solution and 1.0 ml of pararosaniline hydrochloride solution. Thoroughly mix and allow 30 minutes for color development.
2. Prepare a 10.0 ml reagent blank in the same manner as the collected samples.
3. With the spectrophotometer at 560 nm, set the reagent blank at 100% transmission.
4. Read the % transmission of each sample and from a standard curve, obtain the total micrograms of  $\text{SO}_2$  collected.

### Preparation of Standard Curve

1. Dissolve 0.4000 g of sodium meta bisulfite (Assay 65.5% as SO<sub>2</sub>) in distilled water and bring to 1 liter in a 1 liter volumetric flask. This yields a solution of approximately 260 µg of SO<sub>2</sub>/ml.
2. Standardize using standard solutions of iodine and thiosulfate (Ref. 2).
3. Make proper dilution with TCM absorbing solution to obtain a working standard containing 2.6 µg SO<sub>2</sub> per ml.
4. Add respectively 0, 1.0, 2.0, 3.0, 4.0 and 5.0 ml of the working standard to a series of graduated test tubes. Add sufficient volumes of absorbing solution to make 10.0 ml of total volume.
5. Develop color as described above in the Analysis Section.
6. Plot % transmission vs. micrograms SO<sub>2</sub> on semi-logarithmic graph paper to obtain the standard curve.

### Calculations

$$\text{PPM} = \frac{\mu\text{g SO}_2 \text{ from standard curve}}{\text{Sample Vol. (in liters)} \times 2.6}$$

### References

1. West, P., Gaeke, Anal. Chem. 28, 1816-19, 1956.
2. Kolthoff and Sandell, Textbook of Quantitative Inorganic Analysis, Third Edition, 1952, MacMillan Co.

## 1.5.7 Hydrogen Sulfide Reference Procedure

### Principle.

The method is based on the absorption of hydrogen sulfide, contained in a dilute calibration stream, by a suspension of cadmium hydroxide and arabino galactan. The formed cadmium sulfide is then reacted with N-N Dimethyl-P-Phenylenediamine dihydrochloride and ferric chloride to make methylene blue. The methylene blue formed, proportional to the hydrogen sulfide absorbed, is measured spectrophotometrically.

## Reagents

- 1. Absorbing Solution.** Dissolve 2.7 g of anhydrous cadmium sulfate and 10 g of arabino galactan in approximately 500 ml of distilled water. Dissolve 0.3 g of sodium hydroxide in approximately 100 ml distilled water. Mix the two solutions slowly while stirring. Add distilled water to make 1 liter of absorbing solution. The absorbing solution is stable for 3 months.
- 2. Test Amine Solution.** Dissolve 0.375 g of N-N dimethyl-P-phenylenediamine dihydrochloride in 100 ml of 1:1 (v/v) sulfuric acid. The solution is stable for 6 months.
- 3. Ferric Chloride Solution.** Dissolve 100 g of  $\text{FeCl}_3 \cdot 6 \text{H}_2\text{O}$  in sufficient water to make 100 ml of solution. The solution is stable for 6 months.

## Apparatus

1. Midget impingers, such as Ace Glass Inc., Cat. No. 7531.
2. Air pump with flow control and with a minimum capacity of 2 liters per minute through a midget impinger.
3. Spectrophotometer, suitable for measurement at  $670 \pm 25 \text{ nm}$ .
4. Flowmeter, 0 to 2 liter per minute range.
5. Stopwatch.

## Sample Collection

1. Preset the air pump to a flowrate of approximately 1 liter per minute. Prepare the sampling train by connecting the flowmeter to the sample manifold (Fig. 1, 1.5.3)
2. Pipet 10.0 ml of thoroughly shaken absorbing solution into a midget impinger. Connect the impinger to the flowmeter and attach the air pump to the exit tube of the impinger.
3. When the calibration stream is stable and at the desired concentration level, start the air pump and the stopwatch. Immediately make the minor adjustment for a desired flow rate of 0.7 liter/min and maintain flow for a time interval sufficient to collect from 3 to 8  $\mu\text{g}$  of  $\text{H}_2\text{S}$ .
4. Take at least two samples for each calibration point.

## Analysis

1. Add consecutively 0.3 ml of test amine solution, and one drop of ferric chloride solution to the contents of each impinger. Thoroughly mix to insure that the precipitate has been dissolved, and allow 30 minutes for color development.

2. Prepare a 10.0 ml reagent blank in the same manner as the samples.
3. With the spectrophotometer set at 670 nm, set the reagent blank at 100% T.
4. Read the % transmission of each sample and from a standard curve, obtain the total micrograms of H<sub>2</sub>S. collected.

### Preparation of Standard Curve

1. Dry a crystal of Na<sub>2</sub>S 9H<sub>2</sub>O with clean absorbent paper and break into small pieces.
2. Dissolve 0.71 g of sodium sulfide in distilled water and bring to 1 liter in a 1 liter volumetric flask. This yields a solution containing approximately 100 µg H<sub>2</sub>S per ml.
3. Standardize immediately prior to use, using standard solutions of iodine and thiosulfate (Ref. 3).
4. Make proper dilution with distilled water so as to obtain a working standard solution containing about 10 ug H<sub>2</sub>S per ml.
5. Add respectively 0, 0.2, 0.4, 0.6, 0.8 and 1.0 ml of the H<sub>2</sub>S working standard to a series of graduated test tubes. Add sufficient volumes of absorbing solution to make 10.0 ml of total volume.
6. Develop color as described above in the Analysis Section.
7. Plot % transmission vs. micrograms H<sub>2</sub>S on semi-logarithmic paper to obtain the standard curve.

### Calculations

$$\text{PPB H}_2\text{S} = \frac{\mu\text{g H}_2\text{S from standard curve} \times 10^3}{\text{Sample Vol. (in liters)} \times 1.4}$$

- 1.6 Reporting.** Data recorded by the required instrumentation shall be examined at least once every seven days to determine whether the allowable limits have been exceeded, and to determine whether the instrumentation has operated properly. Instrument downtime exceeding a continuous 24 hours period and recorded data exceeding allowable limits shall be reported to the APCO within the next normal working day following examination.

A summary of data obtained during each calendar month shall be submitted to the APCO via electronic medium within 30 days following the end of the month. The summary shall include excesses over allowable limits, mass emission rate from sources, and notations for instrument downtime or other loss of data. Unless a substitute summation of data is specified by the APCO, the monthly data summary shall be the one hour averages either by: (1) summing one minute averages and dividing by the number of minutes (at least 45 valid samples per hour) from electronically collected data (e.g., data logger); or (2) the continuous strip chart data broken into discrete clock hours. Unless specified above, the format of the data and informational summaries shall be determined by the APCO.

### References

1. Jacobs, et al, Anal. Chem. 29, 1349, 1957.
2. Bamesberger, Adams Environ. Sci. and Tech. 3, 258-61 (1969).
3. Kolthoff and Sandell, Textbook of Quantitative Inorganic Analysis, Third Edition, 1952, MacMillan Co.

## 2. ATMOSPHERIC SAMPLING OF GROUND LEVEL LEAD CONCENTRATIONS

REF: Refs. 1-510      11-1-501  
11-1-602,      11-1-603

- 2.1 General.** This section outlines the procedures to be used for calculation of mass emission limits and for atmospheric sampling of ground level lead concentrations in order to fulfill the requirements of Regulations 11-1-302 and 11-1-303.
- 2.2 Mass Emission Limitations.** Emission limitations required to meet Regulation 11-1-302 shall be determined by use of equations 4.1 and 5.13, and Figures 3-3 and 3-9, in "Workbook of Atmospheric Dispersion Estimates", by D. Bruce Turner, Public Health Service Publication No. 999-AP-26, Revised 1969, published by the US. Department of Health, Education and Welfare. In using said equations and figures, a neutral or "D" stability category shall be assumed, a wind shall be assumed that remains throughout the averaging period directed within a 22.5° Sector of the compass rose at an average speed of two meters per second, and an ambient air temperature of 293°K shall be assumed.
- 2.3 Instrumentation.** The person responsible for emissions of lead, who has elected to be regulated by Regulation 11-1-303 shall provide, install and maintain not less than four directionally controlled high-volume samplers located in the area surrounding the source and shall provide at least one recording meteorological station equipped to record wind speed and wind direction.
- 2.3.1 Instrument Specification.** High-volume samplers, as described in Appendix B, "Reference Method for the Determination of Suspended Particulate in the Atmosphere (High-Volume Method)", Federal Register, Vol. 36, No. 84, Friday, April 30, 1971, shall be fitted with a control device which will cause the sampler to operate only during those periods when the ambient airflow to the sampler is from a specified sector. Means shall be added to record the elapsed time of sampler operation.
- 2.3.2 Meteorological Instrument Specifications.** Meteorological instruments shall be capable of continuously measuring and recording wind direction and wind speed in accordance with Section 1.2.3.

**2.4 Instrument Siting.** High-volume samplers shall be positioned in pairs along vectors of wind direction passing over the source. The number of wind vectors required for monitoring of a site shall be determined from a wind rose applicable to the site. The wind rose shall be as described in "Some Applications of Statistics to Meteorology," by Hans Panofsky and Glenn Briar, Mineral Industries Extension Service, Pennsylvania State University, pages 15-16, 1958. Two such wind roses shall be used, one for the period November through April, and one for the period May through October. The requirements of this section apply to each one independently.

On each wind rose, a primary vector is drawn in the direction of the most frequent winds, and passing through the emission point. This vector is the centerline of a sector of 45° of arc (vector direction plus and minus 22.5°). Similar treatment of at least one additional vector shall be provided to ensure that the sectors as a group encompass at least one-half of the exposure indicated by the wind rose.

A pair of samplers shall be installed along each vector. One shall be upwind, and its data will be used in determining background concentrations; the other shall be downwind, and its data will be used in determining source-impacted concentrations. These samplers shall be located as close as possible to the points at which maximum ground level concentrations are predicted by dispersion analysis to occur most frequently. In no case shall the location of the sampler be on the property on which the emissions occur unless the person responsible for monitoring agrees in writing that such location shall, for the purpose of District requirements, be deemed off the property.

Meteorological instruments shall be placed in accordance with Section 1.3.

Positioning of all instruments shall be determined in consultation with the APCO.

**2.5 Instrument Operation.** The monitoring system shall be operated for 24 consecutive hours at least once every three days. During this period, meteorological instruments shall be operated continuously; and all samplers in the system shall be ready to operate, and shall operate whenever the wind direction is within the sector for which controls are set. Samplers shall be operated, and samples obtained, in accordance with the specifications as described in Appendix B, "Reference Method for the Determination of Suspended Particulate in the Atmosphere (High-Volume Method)", Federal Register, Vol. 36, No. 84, Friday, April 30, 1971.

**2.5.1 Filter Media.** Glass-fiber filters having an initial collection efficiency of at least 99 percent for particles of 0.3  $\mu\text{m}$  diameter are suitable for sample collection.

- 2.6 Maintenance.** Care and maintenance shall be such that the instruments will function properly and record the lead concentrations in the area.
- 2.7 Calibration.** Calibrations shall be performed to assure that the volume of air sampled is accurately known. High-volume sampler calibrations shall be performed by use of the Calibration Procedure in Appendix B - Reference Method for the Determination of Suspended Particulate in the Atmosphere (High-Volume Method), Federal Register, Vol. 36, No. 84, Friday, April 30, 1971 or any equivalent method.
- 2.8 Analysis.** Lead collected on the filters shall be analyzed by Laboratory Procedure No. 4A "Determination of Lead Content in Atmospheric Particulate Matter". The APCO may require submission of filter samples for comparative analysis.
- 2.8.1 Data Analysis.** Arithmetic means of lead concentrations shall be computed from all samples obtained during a thirty day period. Two separate arithmetic means shall be computed, one for all the background samples and one for all samples influenced by the source. All means shall be running means, updated at each subsequent 24-hour sample to include data for a thirty day period.
- 2.9 Reporting.** A summary of data obtained from sampling and analysis and from the meteorological instrumentation, shall be submitted to the APCO within 30 days following the end of the month.



### 3. ATMOSPHERIC SAMPLING OF GROUND LEVEL BERYLLIUM CONCENTRATIONS

REF: Refs. 1-510  
11-3-602, 11-3-303

- 3.1 General.** This section outlines the procedures to be used for atmospheric sampling of ground level beryllium concentrations.
- 3.2 Siting.** Stationary sources subject to Regulation 11-3-303 shall locate air sampling sites in accordance with a plan approved by the APCO. Sampling sites must be sufficient in number and shall be located in such a manner as is calculated to detect maximum concentrations of beryllium in the ambient air. The APCO may at any time require changes in, or expansion of, the sampling network.
- 3.3 Sampling Collection.** Samples for analysis shall be collected on filter media using an appropriate air mover. Filters having an initial collection efficiency of at least 99 percent for particles of 0.3  $\mu\text{m}$  diameter are suitable for sample collection. The sample must be of sufficient size to accommodate the analytical technique employed.
- All monitoring sites shall be operated continuously except for a reasonable time allowance for instrument maintenance and calibration, for changing filters, for repair or replacement of equipment.
- 3.4 Analysis.** Filters shall be analyzed and concentrations calculated within 30 days after sample collection. Refer to Laboratory Procedure 2, "Determination of Beryllium in Effluent and Atmospheric Particulate Matter", contained in this manual, for the analytical procedure.
- 3.5 Reporting.** A summary of data obtained during each calendar month shall be submitted to the APCO within 30 days following the end of the month by registered mail.

#### 4. ATMOSPHERIC SAMPLING OF GROUND LEVEL BERYLLIUM CONCENTRATIONS FROM BERYLLIUM ROCKET MOTOR FIRING

REF: Refs. 11-4-301 11-4-302,  
11-4-601

- 4.1 General.** This section outlines the procedures to be used for atmospheric sampling of ground level beryllium concentrations from beryllium rocket motor firing.
- 4.2 Siting.** Sources subject to Regulation 11-4-301 shall monitor ambient air concentrations during and after the test site operation, in accordance with a plan approved by the APCO. Sampling locations must be sufficient in number and shall be located in such a manner as calculated to detect maximum concentrations of beryllium in the ambient air.
- 4.3 Sample Collection.** Samples for analysis shall be collected on filter media using an appropriate air mover. Filters having an initial collection efficiency of at least 99 percent for particles of 0.3  $\mu\text{m}$  diameter are suitable for sample collection.
- The sample must be of sufficient size to accommodate the analytical technique employed.
- 4.4 Analysis.** All samples shall be analyzed and results shall be calculated within 30 days after samples are taken and before any subsequent rocket motor firing or propellant disposal at the given site. Refer to Laboratory Procedure 2, "Determination of Beryllium in Effluent and Atmospheric Particulate Matter", for the analytical procedure.
- 4.5 Reporting.** Concentrations measured at all sites shall be reported to the APCO by a registered letter dispatched before the close of the next business day following determination of such results.