

Tip of the Week

April 10, 2006



The Origins of CleanAir Method 8B for Controlled Condensation

The [CleanAir Method 8B](#) procedure is very similar to one described in a report entitled "Miniature Acid Condensation System: Design and Operation" written by J. L. Cheney of the U. S. EPA Office of Research and Development, Environmental Sciences Research Laboratory. This report, referred to as Report No. EPA 600/3-84-056, and sometimes as the MACS report, was published in April 1984.

The MACS report describes the design and construction of an extractive wet chemistry system for the measurement of gaseous sulfuric acid and sulfur dioxide from combustion sources. The impetus for the work as reported by the author was the lack of a commercially-available manual sampling system for the measurement of sulfuric acid at the time of report publication.

History of Controlled Condensation Methods

During the early 1970's, the American Society for Testing Materials (ASTM) developed a test method in order to try to accurately determine the H₂SO₄ concentrations in coal-fired power plants. This method known as D3226-73T, published as a tentative test method in 1973, uses a glass condenser coil followed up by a frit kept in a hot water bath (150°F - 180°F). This temperature is low enough to condense out any gaseous SO₃ and high enough to keep from condensing and collecting any moisture. However, some problems were encountered with the test method. The original test method used a glass wool plug at the probe tip as a filter. It was found that particulate matter could adsorb SO₃ during sampling and low results were obtained. In 1977, EPA sponsored research performed by TRW yielded an answer to this problem when sampling eastern coals. It incorporated the use of a quartz lined probe at 600 °F and a quartz filter at 550 °F. These elevated temperatures assured little or no adsorption of gaseous SO₃ onto glassware (probe) or onto dust caught on the filter. Interestingly enough, ASTM dropped test method D3226- 73T in 1978 following publication of the TRW paper.

This report and the associated procedure were developed in response to a perceived need for a practical, portable, and reliable H₂SO₄ sampling system. It builds on the work of previous investigators including the ASTM¹, Dietz², Maddalone³, and Cheney⁴. This system formed the basis of what became known as the "Consol Method" as reported by the late Matt Devito⁵.

The information contained in the MACS report does not constitute a formal EPA source testing methodology, and was probably not intended to be one. The report provides general guidelines for building and using the MAC sampling system in the field. It is lacking in areas quality assurance, quality control, audit samples, and field blanks.

CleanAir's Development of Method 8B

CleanAir addressed several potential limitations of the MAC system in the development of CleanAir Method 8B. Most notably:

1. **Probe Temperature.** Cheney refers to maintaining the probe temperature at or above 520 °F. CleanAir's Method 8B specifies maintaining a probe temperature of at least 600 °F in order to minimize H₂SO₄ adsorption on the probe liner internal surfaces.
2. **Filter Temperature.** Cheney recommends maintaining a filter temperature at or above 520 °F. CleanAir's Method 8B specifies maintaining the filter temperature at or above 550 °F in order to minimize H₂SO₄ loss due to adsorption on the filter ash cake.
3. **Glass Wool Quality Assurance.** CleanAir recommends soaking the glass wool used for the condenser plugs in 0.1N H₂SO₄ for a period of 24 hours prior to the start of any testing in order to remove impurities that might bias the test results. The glass wool is then rinsed with DI water. The final rinse is analyzed for sulfate. If the final rinse sulfate level exceeds the blank level, then the procedure is repeated until the final rinse is at or below the blank level.
4. **Hydrogen Peroxide.** Method 8B specifies that the 3% H₂O₂ solution should be prepared fresh on a daily basis.
5. **Hydrogen Peroxide Blanks.** Method 8B specifies that a blank of the H₂O₂ absorbing solution should be obtained.
6. **Filters.** CleanAir recommends the use of high purity, sulfate free particulate filters such as Pallflex 2500QAT-UPTM or equivalent. We also recommend replacing the filter after each test run.

Thanks to Jack Bionda for researching and summarizing this information.

REFERENCES

1. American Society for Testing and Materials (ASTM) Method D3226-73T. *Tentative Method of Test for Sulfur Oxides in Flue Gases (Barium Chloranilate-Controlled Condensation Method)*. 670-677. 1973. (Method Withdrawn in 1978).
2. Dietz, R. N., "Report on the Working Group on Measurement of Gaseous Sulfur Oxide Emissions," in Proceedings of Workshop on Measurement Technology and Characterization of Primary Sulfate Emissions from Combustion Sources, EPA-600/9-78-020a, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, 1978, p. 140.
3. Maddalone, R. F., "Sulfur Emissions Sampling and Analysis," in Proceedings of Workshop on Measurement and Characterization of Primary Sulfate Emissions from Combustion Sources, EPA-600/9-78-020b, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, 1978, p. 219.
4. Cheney, J. L. and Homolya, J. B., "Characterization of Combustion Source Sulfate Emissions with a Selective Condensation System," in Proceedings of Workshop on Measurement and Characterization of Primary Sulfate Emissions from Combustion Sources, EPA-600/9-78-020a, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, 1978, p. 53.
5. DeVito, M. S. and Smith, D. L., "Sampling and Analysis of SO₃ in Coal-Fired Power Plants Using the Controlled Condensation Method," Stack Sampling and Source Evaluation Conference, Santa Barbara, CA, November 11-16, 1990.