



## Project Summary

# Technical Assistance Document for Sampling and Analysis of Toxic Organic Compounds in Ambient Air

R. M. Riggins

**The objective of this project is to develop a Technical Assistance Document (TAD) for sampling and analysis of toxic organic compounds in ambient air. The primary users of this document are expected to be regional, state, and local environmental protection personnel who need to determine ambient air quality for regulatory or information-gathering purposes.**

**The TAD consists of the following four sections:**

- (1) Introduction**
- (2) Regulatory Issues Related to Toxic Organic Monitoring**
- (3) Guidelines for Development of a Monitoring Plan**
- (4) Sampling and Analysis Techniques**

**A topical index is included to assist the reader in locating pertinent subjects within the document.**

*This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).*

### Introduction

The objective of this project was to develop a Technical Assistance Document (TAD) to aid technical and program management personnel within regional, state, and local environmental protection organizations in analyzing toxic organic compounds in ambient air. The scope of the document

is broad enough so that others may use it for designing monitoring programs.

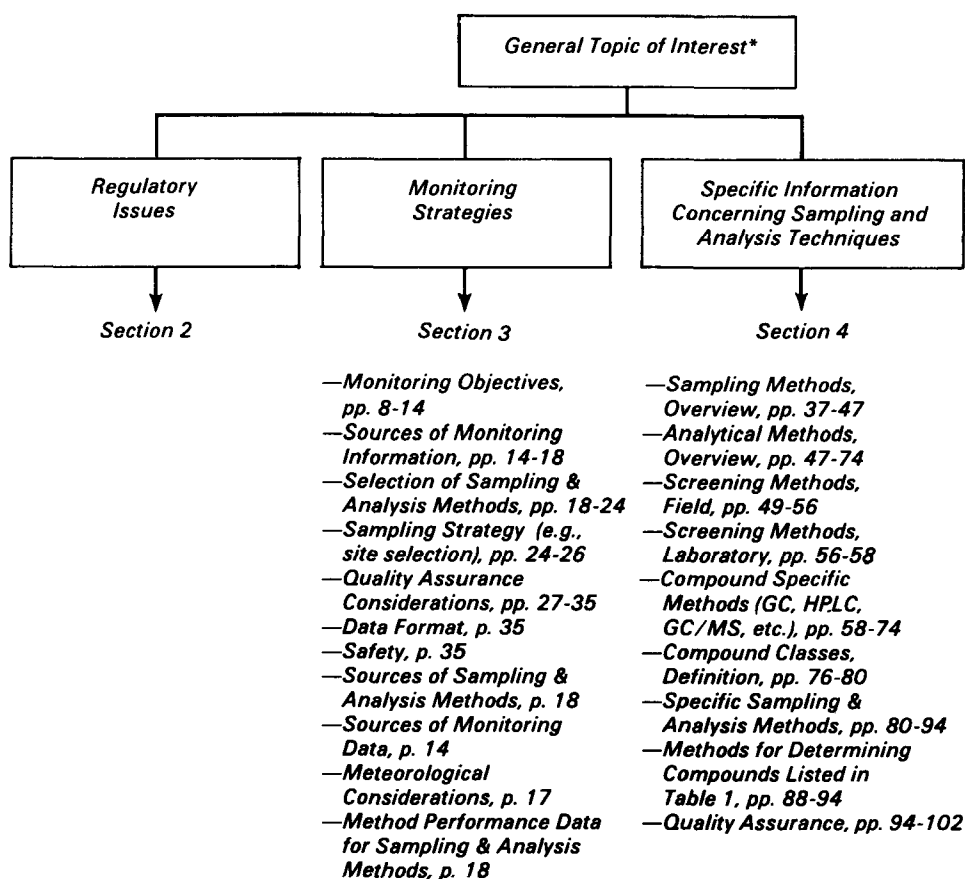
The TAD is not intended to be a single source of technical information but should be used as an overview document, with the user consulting referenced information in the TAD as required.

Federal, state, local, and regional regulations concerning the control of toxic organic chemical emissions have resulted in monitoring programs for toxic organic chemicals in ambient air. Unfortunately, adequate information about sampling and analysis of such compounds in ambient air is not readily available. Also, many technical difficulties encountered in such monitoring programs have not been adequately documented. Therefore, the purpose of the TAD is to detail regulatory issues, monitoring strategies, and sampling and analysis methods.

### Structure of the TAD

Figure 1 shows the four major sections and associated subsections of the TAD. The first section is an introduction. The second section deals with regulatory policy and public issues. Special emphasis is given to regulatory or public objectives as they relate to the technical design and implementation of monitoring programs.

The third section presents a set of detailed guidelines for developing an ambient air monitoring program. The procedure for defining objectives, compiling existing information, selecting sampling and analysis methods, selecting a sampling strategy, specifying QA and safety procedures, and defining data format is



Nitrobenzene  
 Nitrosomorpholine  
 Perchloroethylene (tetrachloroethylene)  
 Phenol  
 Phosgene  
 Polychlorinated biphenyls  
 Propylene oxide  
 Toluene  
 Trichloroethylene  
 Vinylidene chloride (1,1-dichloroethylene)  
 o-,m-,p-Xylene

Figure 1. Topical flowchart for technical assistance document.\*

\*Consult Index for specific topics.

presented. The intended purpose of this section is to give the reader an appreciation for the factors to be considered in designing a monitoring program at each stage of development. The development process is actually iterative, and conflicts between overall objectives and sampling and analysis limitations must be resolved through modification or technical refinement.

The final section reviews sampling and analytical techniques and describes screening and specific methods. Also, physical and chemical properties of compounds used to select appropriate methods are discussed. This aspect of the document is very important because methods for determining certain compounds have not been devised. Analyzing several compounds with one method is less costly than monitoring each compound by a specific method.

The TAD also details specific methodology that may be used to analyze the compounds presented in Table 1. These compounds are currently being considered for regulation under the Clean Air Act. This method-

ology might also be used to analyze chemicals similar to those listed in Table 1.

Table 1. Organic Compounds Being Considered for Regulation Under Clean Air Act Amendments

Acetaldehyde  
 Acrolein  
 Acrylonitrile  
 Allyl chloride  
 Benzyl chloride  
 Carbon tetrachloride  
 Chlorobenzene  
 Chloroform  
 Chloroprene  
 o-,m-,p-Cresol  
 p-Dichlorobenzene  
 Dimethyl nitrosamine  
 Dioxin (2,3,7,8 tetrachlorodibenzodioxin)  
 Epichlorohydrin  
 Ethylene dichloride  
 Ethylene oxide  
 Formaldehyde  
 Hexachlorocyclopentadiene  
 Maleic anhydride  
 Methyl chloroform (1,1,1 trichloroethane)  
 Methylene chloride (dichloromethane)

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L. J. Purdue and H. G. Richter are the EPA Project Officers (see below).  
The complete report, entitled "Technical Assistance Document for Sampling and  
Analysis of Toxic Organic Compounds in Ambient Air," (Order No. PB 83-239  
020; Cost: \$14.50, subject to change) will be available only from:*

*National Technical Information Service  
5285 Port Royal Road  
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## Project Summary

# A Summary of the 1981 EPA National Performance Audit Program on Source Measurements

E. W. Streb, R. G. Fuerst, and M. R. Midgett

In the spring and fall of 1981, the Quality Assurance Division (QAD) conducted its semi-annual National Audits for certain Stationary Source Test Methods. The audit materials consisted of: a critical orifice for Method 5 (dry gas meter only), five simulated, liquid samples each for Method 6 (SO<sub>2</sub>) and Method 7 (NO<sub>x</sub>), and two coal samples for Method 19. Industrial laboratories, contractors, universities, foreign laboratories, and local, state and Federal agencies participated.

For the Method 5 spring audit, the mean for all participants differed by 13.6% from the true (EPA) value. For the fall audit, participants' mean was 4.3% from the true value. In the two Method 6 audits, the median values measured for 9 of 10 samples differed by less than 1% from the true value, whereas the median values for all 10 samples used in the two Method 7 audits were within 2% of the true value. This was the first coal audit conducted by QAD. For the sulfur, ash, and moisture analysis, the participants' accuracy was consistently better for the higher concentration samples than for the lower concentration samples.

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### Introduction

In 1977 the Environmental Monitoring Systems Laboratory (EMSL) of EPA estab-

lished a performance audit program to evaluate the performance of organizations that conduct source testing using EPA Reference Methods. By participating in this free and voluntary program, users of these methods can compare their performance to other laboratories conducting similar measurements.

Laboratories participating in the audits sent their data to the Source Branch and later received a written report comparing their results to EPA's. The participants had eight weeks to return data to EPA. At the end of this period, all data were statistically analyzed to determine the participants' precision and accuracy.

### Audit Materials

In the Method 5 audit procedure, participants use a critical orifice to check the calibration of the dry gas meter in their EPA Method 5 meter box. This device allows a participant to compare his measured volume to EPA's expected volume.

A summary of the 1981 Method 5 audit shows that 76% of the 350 laboratories that requested samples returned data for the spring and fall audits. The Code of Federal Regulations requires that the dry gas meter be calibrated to an accuracy of within 2 percent, so this was used as the criterion for accuracy. Only 42% of the reporting laboratories in the 0381 audit and 44% in the 0981 audit obtained this accuracy.

For the Method 6 audit, a sample set of five different dilutions of sulfuric acid was prepared. This audit checks the participant's ability to analyze a Method 6 sample for SO<sub>2</sub>.

A summary of the 1981 Method 6 audit shows that 70% of the 311 laboratories

requesting samples returned data for the spring and fall audits. Two percent was chosen as the criterion for accuracy. Of all the data returned an average of 55% of the participants achieved an accuracy within 2%.

For the Method 7 audit, a sample set of five concentrations of potassium nitrate was prepared. This audit checks the participant's ability to analyze a Method 7 sample for NO<sub>x</sub>.

A summary of the 1981 Method 7 audit shows that 66% of the 250 laboratories requesting samples returned data for the spring and fall audits. Three percent was chosen as the criterion for accuracy. Of all the data returned, an average of 35% of the participants achieved an accuracy of 3% for both audits.

The first coal audit by the Quality Assurance Division was conducted in 1981. This audit made use of two 60-mesh coal samples. Participants analyzed each coal sample for BTU content and percent sulfur, moisture, and ash.

A summary of the 1981 coal audit results shows that 83% of the 77 laboratories that requested samples returned data. Five percent was chosen as the accuracy criterion for each of the four parameters. For the high concentration of sulfur and moisture, 61% and 80%, respectively, of the analyses were within 5% of the expected value. However for the low concentration of sulfur and moisture, only 16% of the analyses were within the 5% criterion. The data for the gross calorific analysis were better, with 92% of the low values and 85% of the high values within 5% of the expected value.

## Recommendations

The Quality Assurance Division of the Environmental Monitoring Systems Laboratory maintains a repository of audit samples for EPA Methods 6 and 7, and for coal. These stable samples are available to any laboratory having a need for them, such as for training new personnel and

conducting quality control checks of the laboratory. Since the expected values for these samples are included with the analysis instructions there is no requirement for the data to be returned to EPA. We recommend that participants make use of this sample repository, to help increase their overall analytical skills.

*The EPA authors E. W. Streib (also the EPA contact, see below), R. G. Fuerst, and M. R. Midgett are with the Environmental Monitoring Systems Laboratory, Research Triangle Park, NC 27711.*

*The complete report, entitled "A Summary of the 1981 EPA National Performance Audit Program on Source Measurements," (Order No. PB 83-252 502; Cost: \$10.00, subject to change) will be available only from:*

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