WEST VIRGINIA

SECRETARY OF STATE

KEN HECHLER

ADMINISTRATIVE LAW DIVISION

FORM #1

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OFFICE OF WEST VIRGINIA SECRETARY OF STATE

NOTICE OF PUBLIC HEARING ON A PROPOSED RULE

AGENCY: Division of Environmental Protection, Office of Air Quality TITLE NUMBER: 45

RULE TYPE: Legislative ;CITE AUTHORITY W. Va. Code §§22-5-1 et seq.

AMENDMENT TO AN EXISTING RULE: YES X NO ____

IF YES, SERIES NUMBER OF RULE BEING AMENDED: 16

TITLE OF RULE BEING AMENDED: "Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60"

IF NO, SERIES NUMBER OF NEW RULE BEING PROPOSED: ____

TITLE OF RULE BEING PROPOSED: ____

DATE OF PUBLIC HEARING: July 19, 1999 TIME: 6:00 p.m.

LOCATION OF PUBLIC HEARING: Office of Air Quality - Conference Room
1558 Washington Street East
Charleston, WV 25311-2599

COMMENTS LIMITED TO: ORAL ____, WRITTEN ____, BOTH X

COMMENTS MAY ALSO BE MAILED TO THE FOLLOWING ADDRESS: Edward L. Kropp, Chief
Office of Air Quality
1558 Washington Street, East
Charleston, WV 25311-2599

The Department requests that persons wishing to make comments at the hearing make an effort to submit written comments in order to facilitate the review of these comments.

The issues to be heard shall be limited to the proposed rule.

ATTACH A BRIEF SUMMARY OF YOUR PROPOSAL

Karen G. Watson
Karen G. Watson, Attorney

$5.60 w/out federal reg's
$22.80 w/ fed. reg's

Executive Office
10 McJunkin Road
Nitro, West Virginia 25143-2506
Telephone: 304-759-0515
Fax: 304-759-0526

West Virginia Bureau of Environment

Cecil H. Underwood
Governor

Michael P. Miano
Commissioner

June 14, 1999

Ms. Judy Cooper
Director, Administrative Law Division
Office of the Secretary of State
Capitol Complex
Charleston, West Virginia 25305

RE: 45CSR16 - "STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES PURSUANT TO 40 CFR PART 60"

Dear Ms. Cooper:

This is to advise that I am giving approval to file the above-referenced rule with your Office as "Notice of Public Hearing/Comment Period."

If you should have questions or require additional information, please contact Carrie Chambers in my office at 759-0515. Your cooperation in this regard is very much appreciated.

Sincerely yours,

Michael P. Miano
Michael P. Miano
Commissioner

MPM:cc

Attachment

cc: Skipp Kropp
Karen Watson
Carrie Chambers

BUREAU OF ENVIRONMENT
DIVISION OF ENVIRONMENTAL PROTECTION

BRIEFING DOCUMENT

Rule Title: 45CSR16 - "Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60"

A. **AUTHORITY:** W.Va. Code §§22-5-1 et seq.

B. **SUMMARY OF RULE:**

This rule adopts standards of performance for new stationary sources promulgated by the United States Environmental Protection Agency pursuant to section 111(b) of the federal Clean Air Act, as amended. It is the intent of the Director to adopt these standards by reference. It is also the intent of the Director to adopt associated reference methods, performance specifications and other test methods which are appended to such standards. This revised rule incorporates by reference additional provisions relating to fossil-fuel fired steam generating units, electric arc furnaces, polymer and resin production facilities and volatile organic compound emissions from the polymer manufacturing industry, and new test methods for velocity and volumetric flow rate determination in stacks and ducts.

C. **STATEMENT OF CIRCUMSTANCES WHICH REQUIRE RULE:**

Any person who constructs, modifies, or reconstructs an affected facility after the effective date of any New Source Performance Standard (NSPS) under 40 CFR Part 60 must comply with the NSPS. The final adoption of the proposed rule amendment will enable the WVDEP to become the primary enforcement authority for NSPS subparts promulgated by U.S. EPA as of June 1, 1999. Promulgation of this rule by the Legislature is necessary for the State to fulfill its responsibilities under the Clean Air Act, as amended.

D. **FEDERAL COUNTERPART REGULATIONS - INCORPORATION BY REFERENCE/DETERMINATION OF STRINGENCY:**

A federal counterpart to this proposed rule exists. In accordance with the Director's recommendation, and with limited exception, the Office of Air Quality proposes that the rule incorporate by reference the federal counterparts.

Because the proposed rule incorporates by reference the federal counterpart, no determination of stringency is required.

E. CONSTITUTIONAL TAKINGS DETERMINATION:

In accordance with §22-1A-1 and 3(c,) the Director has determined that this rule will not result in taking of private property within the meaning of the Constitutions of West Virginia and the United States of America.

F. CONSULTATION WITH THE ENVIRONMENTAL PROTECTION ADVISORY COUNCIL:

At their June 10, 1999 meeting, the Environmental Protection Advisory Council reviewed and discussed this rule - there were no substantive changes as a result of their discussion. (See attached minutes of that meeting.)

SUMMARY OF NSPS ACTIONS
Federal Registers
June 2, 1998 - June 1, 1999

- Subject -	- Class -	- Summary -
September 16, 1998		**Vol. 63, No. 179**
NSPS: New Fossil-Fuel Fired Steam Generating Units	Final Rule	This action promulgates revised standards of performance regarding NOx emissions and also revises reporting requirements.
February 12, 1999		**Vol. 64, No. 29**
NSPS: Recordkeeping and Reporting Burden Reduction	Final Amendments	This action finalizes changes to reduce unnecessary reporting and recordkeeping burdens.
March 2, 1999		**Vol. 64, No. 40**
NSPS: Steel Plants: Electric Arc Furnaces Constructed After October 21, 1974 and On or Before August 17, 1983, and Electric Arc Furnaces Constructed After August 17, 1983	Direct Final Rule; Amendments	This action adds alternative requirements for the monitoring of EAF capture systems and also revises two definitions for consistency.

SUMMARY OF NSPS ACTIONS
Federal Registers
June 2, 1998 - June 1, 1999

- Subject -	- Class -	- Summary -
March 9, 1999		**Vol. 64, No. 45**
NSPS: Polymer and Resin Production Facilities (Groups I and IV) and Volatile Organic Compound (VOC) Emissions From the Polymer Manufacturing Industry	Direct Final Rule	This action amends §60.564(h) by correcting the equation used for computing the emission rate of total organic compounds.
May 5, 1999		**Vol. 64, No. 86**
NSPS: Title 40 of the Code of Federal Regulations	CFR Correction	This action adds the following definitions to §60.41c: *coal, coal refuse, cogeneration steam generating unit, and combined cycle system.*
May 14, 1999		**Vol. 64, No. 93**
NSPS: Test Methods: Three New Methods for Velocity and Volumetric Flow Rate Determination in Stacks or Ducts	Direct Final Rule	This action approves three new optional test methods for utility units subject to the Acid Rain Program and certain large generating units that may become subject to the Nox SIP call.

MINUTES

ENVIRONMENTAL PROTECTION ADVISORY COUNCIL

June 10, 1999, Director's Conference Room, Nitro

The sixteenth meeting of the DEP Advisory Council was held Thursday, June 10, 1999, in the Director's Conference Room located in Nitro. Chairman Mike Miano called the meeting to order at 10:00 a.m.

ATTENDING:

Advisory Council Members:

Mike Miano, Chairman
Jacqueline Hallinan
William Raney
Rick Roberts
William Samples

Environmental Protection:

Bill Adams	**Pam Nixon**
Andy Gallagher	**Rocky Parsons**
Tony Grbac	**Cap Smith**
Randy Huffman	**Charlie Sturey**
Mike Johnson	**Barbara Taylor**
Mike Lewis	**Karen Watson**
Robert Keatley	**Mike Zeto**

1) Review and Approval of March 22, 1999 Minutes. Chairman Miano called the meeting to order at 10:00 a.m. The first item on the agenda was approval of the minutes of the March 22 Advisory Council; they were approved as written.

2) Discussion of Proposed Rule Amendments - 2000 Legislative Session. In accordance with WV Code §22-1-1(c), and DEP's new rule-making procedure that was implemented by Director Miano in September 1998 to involve the Advisory Council in DEP's rule-making process as early as possible to enable the Council to review, comment, and make recommendations to the Director on DEP's proposed legislative rule changes before they are filed for public hearing, the following proposed rules were brought to the Council's attention.

Chairman Miano said he would like to begin by saying he hoped all Council members had received their draft rules by E-mail without any complications and they were able to review them before the meeting. He informed the Council that due to the large number of rules being proposed for the 2000 Legislative Session, DEP's program offices would review them with the

Council as thoroughly as possible, in the allotted time frame, and try to answer any questions or concerns the Council may have.

The following Office of Air Quality's proposed rule amendments were discussed by Karen Watson, OAQ, with assistance from Richard Keatley, also from the OAQ office:

- **45CSR1 - "TO PREVENT AND CONTROL AIR POLLUTION FROM COAL REFUSE DISPOSAL AREAS"**
- **45CSR2 - "TO PREVENT AND CONTROL PARTICULATE AIR POLLUTION FROM COMBUSTION OF FUEL IN INDIRECT HEAT EXCHANGERS"**
- **45CSR3 - "TO PREVENT AND CONTROL AIR POLLUTION FROM THE OPERATION OF HOT MIX ASPHALT PLANTS"**
- **45CSR4 - "TO PREVENT AND CONTROL THE DISCHARGE OF AIR POLLUTANTS INTO THE OPEN AIR WHICH CAUSES OR CONTRIBUTES TO AN OBJECTIONABLE ODOR OR ODORS"**
- **45CSR5 - "TO PREVENT AND CONTROL AIR POLLUTION FROM THE OPERATION OF COAL PREPARATION PLANTS, COAL HANDLING OPERATIONS AND COAL REFUSE DISPOSAL AREAS"**
- **45CSR6 - "TO PREVENT AND CONTROL AIR POLLUTION FROM COMBUSTION OF REFUSE"**
- **45CSR7 - "TO PREVENT AND CONTROL PARTICULATE MATTER AIR POLLUTION FROM MANUFACTURING PROCESSES AND ASSOCIATED OPERATIONS"**
- **45CSR10 - "TO PREVENT AND CONTROL AIR POLLUTION FROM THE EMISSION OF SULFUR OXIDES"**
- **45CSR12 - "AMBIENT AIR QUALITY STANDARD FOR NITROGEN DIOXIDE"**
- **45CSR16 - "STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES PURSUANT TO 40 CFR PART 60"**
- **45CSR17 - "TO PREVENT AND CONTROL PARTICULATE MATTER AIR POLLUTION FROM MATERIALS HANDLING, PREPARATION, STORAGE AND OTHER SOURCES OF FUGITIVE PARTICULATE MATTER"**
- **45CSR18 - "TO PREVENT AND CONTROL PARTICULATE AIR POLLUTION FROM DIRECT MEAT-FIRING DEVICES"**
- **45CSR23 - "TO PREVENT AND CONTROL EMISSIONS FROM MUNICIPAL SOLID WASTE LANDFILLS"**
- **45CSR25 - "TO PREVENT AND CONTROL AIR POLLUTION FROM HAZARDOUS WASTE TREATMENT, STORAGE, OR DISPOSAL FACILITIES"**
- **45CSR33 - "ACID RAIN PROVISIONS AND PERMITS"**
- **45CSR34 - "EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS PURSUANT TO 40 CFR PART 63"**

Karen began by bringing the Council up to date on the status of two OAQ rules that were filed during the last session (or late in the session). 45CSR8 revised the ambient air quality for sulfur oxides and particulate matter, and 45CSR9 pertained to ambient air quality standards for carbon monoxide and ozone. The DC Circuit Court of Appeals has ordered EPA to show how they arrived at the new standards - EPA may go back to the previous standards. Karen also apprised the Council on the N_{ox} State Implementation Plan. The Circuit Court stayed the implementation of that rule and there are no plans to develop any other amendments in the immediate future. 45CSR28, which is the emissions trading rule that was filed late in the 1999 Session, was not taken up by the Legislature, but plans are to put the rule on the July agenda of the Interim Legislative Committee.

Karen explained the reason for the unusually large number of DEP rules that are being filed for the next Legislative Session. She informed the Council that several of the rules were outdated and were amended for consistency and streamlining, and are a result of months of on-going meetings with stakeholders -- involving both the regulated community and citizens. A particulate matter and sulfur oxide work group was also involved. Those rule amendments as a result of the stakeholders process include: 45CSR1 (which is being repealed and replaced with language in 45CSR5), 45CSR2, 3, 4, 5, 6, 7, 10, 12, 17, and 18 (which is being repealed since the rule is no longer deemed necessary). The amendments to the remainder of the rules, 45CSR16, 23, 25, 33, and 34 were necessary to adopt by reference definitions, clarifications, technical amendments, etc., recently adopted by US EPA.

After several minutes of discussion, the Advisory Council recommended to the Director that the following amendments be made to the OAQ rules:

Mr. Samples pointed out that 45CSR2 and 45CSR7 contain different definitions for the term "opacity." The agency responded that this discrepancy was inadvertent and the language should be as it is in 45CSR2. The agency agreed to revise 45CSR7, subsection 2.23, accordingly.

Mr. Larry Harris was unable to attend the meeting; however, he expressed the following comments on 45CSR10 and 45CSR33 by e-mail. He stated that the State's rules should be more stringent than the federal counterpart regulations, since the State's streams are being adversely impacted. The agency responded that, at this point in time, it does not possess sufficient evidence to make the written finding that is required by WV Code §22-2-3a before promulgating a rule which is more stringent than a counterpart federal regulation.

<u>Cap Smith and Mike Zeto discussed the following Office of Waste Management proposed rule amendments:</u>

- **33CSR2 - "Sewage Sludge Management Rule"**
- **33CSR20 - "Hazardous Waste Management Rule"**

Mike Zeto briefed the Council on the proposed amendments to 33CSR2. He stated that in 1996 the Legislature mandated DEP to perform a study on soil limitations for sewage sludge land application sites. These amendments (as a result of the study) were to be proposed by June 30, 1999. Other amendments to the rule include specifying the analytical method used for soil analysis, placing conditions on variances from the soil limits for land application sites, providing an incentive for municipalities to produce higher quality compost products, and adjusting the sewage sludge limits for four metals. Mr. Zeto told the Council these amendments are being proposed to update other related areas of the rule in an attempt to provide better management of sewage sludge within the state.

Cap Smith discussed 33CSR20 with the Council. He informed the Council that amendments are proposed in section 2 of the rule that will allow the Office of Waste Management to delist hazardous wastes, which has previously been handled by EPA. The other significant amendments that are being proposed by adoption of the Federal Register pertain to revision standards for owners and operators of closed and closing hazardous waste management facilities, post closure permit requirements, and the closure process. These amendments are referenced throughout the rule and will hopefully expedite site cleanup while maintaining environmental protection.

There were several minutes of discussion on OWM's proposed rule amendments; however, no recommendations were made to the Director concerning the amendments.

Mike Lewis, Office of Oil and Gas, discussed the following new proposed rule:

- **35CSR7 - "Well Operations - Within and Around Gas Storage Reservoirs"**

Mike informed the Council that 35CSR7 is a proposed "new" rule for the O&G Office. The rule is needed to provide protection of the environment, the public, and the state's natural gas resources. It is the intent of the proposed rule to accomplish this by addressing certain operating procedures that oil and gas and gas storage operators are to use when drilling into or through a gas storage reservoir or the gas storage reservoir protective area. In order to assure absence of leaking gas, the proposed rule requires gas storage operators to conduct monitoring and inspections of gas storage wells.

There were no questions or discussion by the Council on this proposed rule.

The following proposed rules were discussed by the Office of Mining and Reclamation:

- **38CSR2 - "Surface Mining and Reclamation Rule"**
- **38CSR2A - "Rules for Mining and Restoration for Sandstone, Limestone, and Sand"**
- **38CSR2B - "RULES FOR MINING AND RECLAMATION OF MINERALS OTHER THAN COAL"**

Ed Griffith, Office of Surface Mining, discussed the proposed amendments to the Surface Mining and Reclamation Rule. Ed told the Council that there are only minor amendments being proposed to this year's rule. The proposed definition of "woodlands" in subsection 2.136 relates to the utilization of commercial woodlands in Approximate Original Contour variance areas. This change is being proposed in order for the state to meet the federal policy that is expected to change in July 1999. The proposed amendment to change the bonding requirements of mining operations that request variances from contemporaneous reclamation to the maximum amount per acre bond ($5,000 per acre) is found in subdivision 14.15.f. All other amendments are being proposed in order to meet the requirements of the Office of Surface Mining's program amendments.

Rocky Parsons, OMR's Philippi Office, next addressed OMR's proposed rules 38CSR2A and 2B. Rocky explained to the Council members that 38CSR2B has been in place since 1983 and regulates all minerals other than coal. However, in accordance with the requirement that separate rules for limestone, sandstone, and sand are to be promulgated, DEP is proposing

38CSR2A which will regulate only those minerals - 38CSR2B will regulate all minerals other than limestone, sandstone, sand, and coal. Both proposed rules will regulate roads, blasting, drainage control, methods of operation, excess spoil disposal, revegetation, mapping, transfer of permits, permit renewals, revisions and incidental boundary revisions. 38CSR2A will provide provisions for restoration and 38CSR2B will include provisions for reclamation. Rocky gave the Council a brief history on the roadblocks the agency has encountered in the past several years in their attempt to amend the quarry statute. He said since the agency has been unsuccessful in that approach, it has become necessary to try to accomplish this through rule making. He informed the Council of a public meeting held the previous week to discuss the two proposed rules. He said the meeting was well attended and he believes the rules were well received by everyone in attendance.

The three OMR proposed rules were discussed by the Council members. Bill Raney said that although Rocky stated that the quarry rules have been well received by industry and the citizens, he is concerned about whether there has been enough time for the review of the proposed rules after they were drafted. He believes there would be a smoother transition into the rule making process, i.e., the public hearing/comment period, etc., if there had been more involvement from outside DEP during the drafting of the rules.

Mr. Larry Harris commented by e-mail 38CSR2A and 2B. His question is whether the siltation measures include silt fences where runoff might enter streams. He said it is not apparent what best management practices are for this situation, and he wonders if it needs to be spelled out. He knows of some operations in quarries where streams muddy after rainfalls, such as the Elkins and Waco quarries near Snowshoe, and he feels this is harming the streams. Do the new rules address this?

Rocky Parsons responded by saying that design criteria for drainage control structures is found in the technical handbook. Silt fences are not adequate for sediment control. The drainage system must be designed to hold .125 ac/ft of sediment for each acre of disturbed land. All runoff must pass through a drainage control structure. There is a provision for less sediment control (1/2 factor) for certain circumstances as approved by the Director. Effluent limits as established in the NPDES permit must be met.

Tony Grbac, Office of Surface Mining, addressed the following rule:

199CSR1 - "SURFACE MINING BLASTING RULE"

Tony began by briefing the Council on the history of the Surface Mining Blasting Rule. This rule is being proposed to comply with SB681 - passed during the last session. This bill created the Office of Explosives and Blasting and the Office of Coalfield Community Development, which is under the West Virginia Development Office. The proposed rule will regulate blasting laws and rules associated with all surface-mining operations. All duties currently performed by OMR related to blasting, and all rules which now regulate blasting (38CSR2C) will be transferred to this new office. Besides regulating blasting on all surface mining operations, it will also implement and oversee pre-blast survey processes; maintain and operate a system to receive and address questions, concerns and complaints relating to mining operations; determine the qualifications for individuals and firms performing pre-blast surveys; establish the education, training, examination and certification of blasters; administer a claims process for property damage caused by blasting; and conduct a study of blasting and make recommendations regarding any appropriate rule or code changes.

Tony explained that the revenue generated by the proposed fee in 199CSR1 (one-half cent times the number of pounds of explosive material used ruing the preceding month for any purpose on the surface mining operations) would fund both the offices, as required by SB681. After one year of collection, both offices are to report to the Legislature as to whether the revenue collected is sufficient to operate both offices.

After several minutes of discussion between DEP and the Council members, Bill Raney expressed his concern in filing the rule for public hearing in the specified time frame. Mr. Raney asked if anyone outside DEP has been involved in drafting the rule. OMR answered by saying the rule was drafted by several staff within OMR. Mr. Raney replied that he believes there will be serious concerns with this rule once industry has had an opportunity to review it. He believes the rule drafting process definitely needs input from firms and individuals outside DEP, and he thinks the process will go smoother once everyone has had the opportunity to address their concerns. Mr. Raney recommended that the Director withhold this rule from the list of rules DEP proposes to file for public hearing/comment period in the coming week to give all interested parties a chance to participate in drafting the rule.

After discussion of this recommendation, Chairman Miano said he believes the best approach would be to continue with the filing of the proposed rule for public hearing, start the rule in the normal process and time frame, and in the meantime he would commit to putting together a work group of interested parties to discuss the rule. If DEP feels that more time is needed once the group begins their work on the rule, he will consider the possibility of either extending the comment period or filing for another public hearing. He said he will also decide in the near future whether DEP will file the rule as an "Emergency Rule" since HB 681 will become effective on June 11.

Council members also pointed out a typographical error in subdivision 3.9.a.3. of the rule relating to cross-references that will be corrected by DEP.

<u>Barb Taylor and Mike Johnson, Office of Water Resources, briefed Council on the following rules</u>:

- **47CSR57A - "Groundwater Protection Standards at Steam Electric Generating Facilities"**
- **47CSR26 - "Water Pollution Control Permit Fee Schedule"**
- **47CSR31 - "State Water Pollution Control Revolving Fund Program Rule"**

Barb described the proposed "new" rule relating to Groundwater Protection Standards at Steam Electric Generating Facilities. She noted that the rule is a result of a Notice of Intent filed on October 24, 1994, by the West Virginia Steam Electric Generation Industry, with the Director of DEP, in accordance with 47CSR57 to apply for a class variance for all West Virginia power stations and associated disposal sites. At that time, DEP provided AEP and AP with the opportunity to conduct a four-year study to gather the necessary data to support their variance request. The objectives were met by assembling and reviewing data, estimating potential impacts to receptors, and performing an economic assessment impact analysis to the industry, commercial enterprises, and citizens at large if compliance with the Groundwater Protection Act were required without benefit of the variances. After review of the four-year study, the Director determined that granting this request for a variance at these locations would not pose adverse effects to human health or the environment. There are no human or environmental sensitive receptors between the coal storage areas or as ponds; therefore, it is unlikely there will be adverse affects. Barb gave each member a copy of the four-year study on which the Director made his determination.

Chairman Miano told Council that DEP is definitely willing to look at such cases where extensive research and study have been done by the regulated community to back up their findings before granting such variances, and believes DEP will see more studies like this in the future.

Barb next apprised the members on the proposed amendments of the Water Pollution Control Permit Fee Schedule. She stated that amendments are being proposed as a result of HB 2684, passed March 11, 1999, and effective ninety days from passage. The Director is required to implement an emergency rule to implement the fee schedule authorized by the amendments by July 1, 1999. This rule was filed as an "Emergency Rule" on June 7, 1999.

Mike Johnson, Office of Water Resources' Construction Assistance Office, briefed the Council on 47CSR31 - the Water Pollution Control Revolving Fund Program rule. The amendments to this rule are being proposed to allow the State Revolving Fund low interest terms to be extended from 20 years to 30 years for communities that qualify as "disadvantaged." There is only one other state in the country to receive such approval from EPA. Mike informed the Council that he was only recently made aware of this extension by EPA to extend the low interest loans from 20 to 30 years while attending a meeting out of state. This rule was filed as an "Emergency Rule" on May 24, 1999.

Council members unanimously agreed that Mike Johnson should be commended for gathering this information and proposing the amendment to the rule that will enable disadvantaged communities to immediately take steps toward constructing watershed projects that will provide affordable monthly sewer rates.

<u>Open Discussion</u>:

Chairman Miano and Council members expressed their compliments to the program offices for all their hard work, especially with the stakeholders process -- it is obvious a lot of hard work has gone into the process in order to make their efforts more productive.

Bill Raney asked a question relating to the "More or Less" Stringency statement that appears on the front of some DEP rules, but not on others, and voiced his concern if DEP is paying close attention to this, or if the same statement is appearing with all proposed rules. Carrie Chambers from the Director's Office explained that statement was once required to be included in the "General" section of each rule; however, it is now placed in the briefing document that is attached to each rule, and required by the Secretary of State's Office and the

Legislative Rule-Making Review Committee, before it is filed. She went on to explain that with the rush to get draft copies of the rules to Council members as soon as possible, some of the Briefing Documents had not been completed, but would be attached to all DEP rules before they are filed for public hearing. Chairman Miano went on to say it is his belief that all program offices are carefully scrutinizing each rule before that decision is made.

Chairman Miano thanked Council for taking time from their busy schedules to review the extensive list of DEP's proposed rules. He informed the Council that the minutes would be left open for comment until Wednesday, June 16, at which time the minutes will be attached to the rules and filed with the Secretary of State's Office and the Legislative Rule-Making Review Committee for notice of public hearing/comment period.

Before adjourning the meeting, the Council informed Chairman Miano that they would prefer beginning future meetings at 10:00 a.m., instead of the usual time of 1:00 p.m. The meeting was then adjourned at 3:30 p.m.

APPENDIX B

FISCAL NOTE FOR PROPOSED RULES

Rule Title: 45CSR16 "Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60"

Type of Rule: X Legislative ____ Interpretive ____ Procedural

Agency: Office of Air Quality

Address: 1558 Washington Street, East

Charleston, WV 25311-2599

1. Effect of Proposed Rule	Annual		Fiscal Year		
	Increase	Decrease	Current	Next	There-after
Estimated Total Cost	$ 0	$ 0	$ 0	$ 0	$ 0
Personal Services	0	0	0	0	0
Current Expense	0	0	0	0	0
Repairs and Alterations	0	0	0	0	0
Equipment	0	0	0	0	0
Other	0	0	0	0	0

2. Explanation of above estimates: Costs anticipated to be incurred in the implementation of federal rules promulgated under 40 CFR Part 60 as of June 1, 1999 will be covered under prior budget estimates for implementing Title V of the Clean Air Act, as amended, under 45CSR30 authorized by the Legislature during the 1994 session and approved (interim approval) by the U.S. Environmental Protection Agency by Final Rule issued on November 16, 1995.

3. Objectives of these rules: This rule adopts standards of performance for new stationary sources promulgated by the USEPA under the federal Clean Air Act, as amended. Promulgation of this rule by the Legislature is necessary for the State to fulfill its responsibilities under the Clean Air Act, as amended.

4. Explanation of Overall Economic Impact of Proposed Rule.

   A. Economic Impact on State Government.

      See Section 2.

   B. Economic Impact on Political Subdivisions; Specific Industries; Specific groups of Citizens.

      No impact above that resulting from the currently applicable federal standards.

   C. Economic Impact on Citizens/Public at Large.

      No impact above that resulting from the currently applicable federal emission standards.

Date: 6/11/99

Signature of Agency Head or Authorized Representative

Karen G. Watson

Karen G. Watson, Attorney

TITLE 45
LEGISLATIVE RULE
DIVISION OF ENVIRONMENTAL PROTECTION
OFFICE OF AIR QUALITY

SERIES 16
STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES PURSUANT TO 40 CFR PART 60

§45-16-1. General.

1.1. Scope. -- This rule adopts standards of performance for new stationary sources promulgated by the United States Environmental Protection Agency pursuant to 42 U.S.C. 7411(b) [C.A.A. §111(b)] of the federal Clean Air Act, as amended. It is the intent of the Director to adopt these standards by reference. It is also the intent of the Director to adopt associated reference methods, performance specifications and other test methods which are appended to such standards.

1.2. Authority. -- W. Va. Code §22-5-1 et seq.

1.3. Filing Date. -- ~~May 20, 1999~~.

1.4. Effective Date. -- ~~June 1, 1999~~.

1.5. Incorporation By Reference -- Federal Counterpart Regulation. The Director has determined that a federal counterpart rule exists, in accordance with the Director's recommendation, and with limited exception, this rule incorporates by reference 40 CFR Part 60, effective July 1, 199~~7~~8, as amended by the Federal Register through June 1, 199~~8~~9.

1.6. Former Rules -- This legislative rule amends 45CSR16 "Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60" which was filed May 20, 1999, and which became effective June 1, 1999.

§45-16-2. Requirements.

2.1. No person may construct, reconstruct, modify, or operate or cause to be constructed, modified, or operated a New Source Performance Standard (NSPS) source which results or will result in violations of this rule.

§45-16-3. Adoption of Standards.

3.1. Standards. -- The Director hereby adopts and incorporates by reference the provisions of 40 CFR Part 60 including any reference methods, performance specifications and other test methods which are appended to such standards and contained in 40 CFR Part 60, effective July 1, 199~~7~~8, as amended by the Federal Register through June 1, 199~~8~~9, for the purposes of implementing a program for standards of performance for new stationary sources, except as follows:

3.1.a. Part 60.9 is amended to provide that information shall be available to the public in accordance with W. Va. Code §§22-5-1 et seq., 29B-1-1 et seq., and 45CSR31.

3.1.b. Sub-parts B, C, Ca, Cb, Cc, Ce, Ea, Ec, and WWW of 40 CFR Part 60 shall be excluded.

§45-16-4. Director.

4.1. Any and all references in said 40 CFR Part 60 to the "Administrator" of the United States Environmental Protection Agency are amended to be the "Director" of the West Virginia Division of Environmental Protection except as follows:

4.1.a. where the federal regulations specifically provide that the Administrator shall retain authority and not transfer such authority to the State;

4.1.b. where provisions occur which refer to:

4.1.b.1. alternate means of emission limitations;

4.1.b.2. alternate control technologies;

4.1.b.3. innovative technology waivers;

4.1.b.4. alternate test methods;

4.1.b.5. alternate monitoring methods;

4.1.b.6. waivers/adjustments to recordkeeping and reporting;

4.1.b.7. emissions averaging;

4.1.b.8. applicability determinations; or

4.1.b.9. the authority to require testing under Section 114 of the Clean Air Act, as amended; or

4.1.c. where the context of the regulation clearly requires otherwise.

§45-16-5. Permits.

5.1. Nothing contained in this adoption by reference shall be construed or inferred to mean that permit requirements in accordance with applicable rules shall be in any way be limited or inapplicable.

§45-16-6. Inconsistency Between Rules.

6.1. In the event of any inconsistency between this rule and any other existing rule of the West Virginia Division of Environmental Protection, such inconsistency shall be resolved by the determination of the Director and such determination shall be based upon the application of the more stringent provision, term, condition, method or rule.

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 60

[FRL–6159–2]

RIN 2060–AE56

Revision of Standards of Performance for Nitrogen Oxide Emissions From New Fossil-Fuel Fired Steam Generating Units; Revisions to Reporting Requirements for Standards of Performance for New Fossil-Fuel Fired Steam Generating Units

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: Pursuant to section 407(c) of the Clean Air Act, the EPA has reviewed the emission standards for nitrogen oxides (NO_X) contained in the standards of performance for new electric utility steam generating units and industrial-commercial-institutional steam generating units. The EPA proposed revisions to 40 CFR part 60, subparts Da and Db based on this review on July 9, 1997. The EPA received 70 public comments on the proposed rule changes. These comments were reviewed, and this document reflects the EPA's responses to the issues raised by the commenters. This action promulgates the revised standards of performance.

The final revisions change the existing standards for NO_X emissions by reducing the numerical NO_X emission limits for both utility and industrial steam generating units to reflect the performance of best demonstrated technology. The final revisions also change the format of the revised NO_X emission limit for new electric utility steam generating units to an output-based format to promote energy efficiency and pollution prevention. However, in a change from the proposed language, the EPA is revising the standard for existing utility boilers that become subject to subpart Da through modification or reconstruction to be in an equivalent input-based format.

As a separate activity, the EPA also reviewed the quarterly sulfur dioxide (SO_2), NO_X, and opacity emission reporting requirements of the utility and industrial steam generating unit regulations contained in subparts Da and Db. The final rules will allow owners or operators of affected facilities to meet the quarterly reporting requirements of both regulations by means of electronic reporting, in lieu of submitting written compliance reports.

DATES: *Effective Date:* The rule revisions are effective November 16, 1998.

Judicial Review: Under CAA section 307(b)(1), judicial review of this nationally applicable final action is available only by the filing of a petition for review in the U.S. Court of Appeals for the District of Columbia Circuit within 60 days of publication of this rule. Under CAA section 307(b)(2), the regulations that are the subject of this action may not be challenged later in civil or criminal proceedings brought by EPA in reliance on them.

ADDRESSES: *Docket:* All information considered by the EPA in developing this rulemaking, including public comments on the proposed rules and other information developed by the EPA in addressing those comments since proposal, is located in Public Docket No. A–92–71 at the following address: U.S. Environmental Protection Agency, Air and Radiation Docket and Information Center (6102), 401 M Street, SW., Washington, DC 20460. The docket is located at the above address in Room M–1500, Waterside Mall (ground floor), and may be inspected from 8:30 a.m. to 4 p.m., Monday through Friday. Materials related to this rulemaking are available upon request from the Air and Radiation Docket and Information Center by calling (202) 260–7548 or 7549. The FAX number for the Center is (202) 260–4400. A reasonable fee may be charged for copying docket materials.

Technical Support Documents. The technical support documents that summarize information gathered during EPA's review of the subparts Da and Db NO_X standards and the public comments and EPA's responses may be obtained from the docket; from the EPA library (MD–35), Research Triangle Park, North Carolina 27711, telephone number (919) 541–2777, FAX number (919) 541–0804; or from the National Technical Information Services, 5285 Port Royal Road, Springfield, Virginia 22161, telephone number (703) 487–4650. Please refer to "New Source Performance Standards, Subpart Da—Technical Support for Proposed Revisions to NO_X Standard", EPA–453/R–94–012, "New Source Performance Standards, Subpart Db—Technical Support for Proposed Revisions to NO_X Standard", EPA–453/R–95–012, or "New Source Performance Standards, Subparts Da and Db—Summary of Public Comments and Responses", EPA–453/R–98–005.

FOR FURTHER INFORMATION CONTACT: For information concerning specific aspects of this rulemaking, contact Mr. James Eddinger, Combustion Group, Emission Standards Division (MD–13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541–5426, electronic mail "eddinger.jim@epa.gov".

SUPPLEMENTARY INFORMATION:

Regulated Entities

Regulated categories and entities include:

Category	Examples of regulated entities
Industry	Electric utility steam generating units, Industrial steam generating units, Commercial steam generating units, and Institutional steam generating units.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table lists the types of entities that the EPA is now aware of that could potentially be regulated by this action. Other types of entities not listed in the table could also be regulated. To determine whether your facility is regulated by this action, you should carefully examine the applicability criteria in §§ 60.40a and 60.40b of the rules. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

Electronic Access and Filing Addresses

This document, the regulatory texts, and other background information are available in Docket No. A–92–71 or by request from the EPA's Air and Radiation Docket and Information Center (see **ADDRESSES**) or may be accessed through the EPA web site at: http://www.epa.gov/ttn/oarpg.

Outline

The following outline is provided to aid in locating information in this document.

I. Background

A. Statutory and Regulatory Authority

Title IV of the Clean Air Act (the Act), as amended in 1990, authorizes the EPA to establish an acid rain program to reduce the adverse effects of acidic deposition on natural resources, ecosystems, materials, visibility, and public health. The principal sources of the acidic compounds are emissions of SO_2 and NO_X from the combustion of fossil fuels. Section 407(c) of the Act requires the EPA to revise standards of performance previously promulgated under section 111 for NO_X emissions from fossil-fuel fired steam generating units, including both electric utility and nonutility units. These revised standards of performance are to reflect improvements in methods for the reduction of NO_X emissions.

The current standards for NO_X emissions from fossil-fuel fired steam generating units, which were promulgated under section 111 of the Act, are contained in the new source performance standards (NSPS) for electric utility steam generating units (40 CFR 60.40a, subpart Da) and for industrial-commercial-institutional steam generating units (40 CFR 60.40b, subpart Db).

B. Benefits of the NSPS Revisions

The revisions being promulgated reflect the Administrator's determination that the best system of NO_X emission reduction (taking into consideration the cost of achieving such emission reduction, any nonair quality health and environmental impact and energy requirements) for these sources is now reflective of flue gas treatment technologies, particularly selective catalytic reduction (SCR). The estimated decrease in baseline nationwide NO_X emissions from new, reconstructed, or modified affected sources resulting from these rule revisions remain unchanged since proposal and are approximately 23,000 Mg/year (25,800 tons/year) from utility steam generating units and 18,000 Mg/year (20,000 tons/year) from industrial steam generating units in the 5th year after proposal. This represents an approximate 42 percent reduction in the growth of NO_X emissions from new utility and industrial steam generating units subject to these revised standards. This reduction in NO_X emissions benefits public health. Nitrogen oxides can cause lung tissue damage, can increase respiratory illness, and are a primary contributor to acid rain and ground level ozone formation. The Agency's estimate of the other environmental, energy, cost, and economic impacts also are unchanged since proposal. (See 62 FR 36957 for more information on these estimates.)

In addition to direct environmental benefits, the EPA believes that the output-based format of the final rule will contribute to important national goals such as pollution prevention. One of the opportunities for pollution prevention lies in simply using energy efficient technologies to minimize the generation of emissions. These revisions promote energy efficiency at utility plants by changing the manner in which they regulate flue gas NO_X emissions. The fuel neutral format of the final rules also contributes to pollution prevention opportunities by encouraging the use of clean fuels without limiting the control options available for compliance.

A third major benefit of these revisions is that the final rules reduce the reporting burden for units subject both to NSPS subpart Da or Db and to other program(s) such as the Acid Rain or NO_X Budget Program. Therefore, the EPA will allow the SO_2, NO_X, and opacity reports currently required under subpart Da or Db to be submitted electronically in lieu of written reports. To implement this electronic reporting option, special electronic data report (EDR) record types would have to be created to accommodate the compliance information required by subparts Da and Db, and sources would be required to obtain an agreement from their EPA Regional office and State authority to use the EDR format. The use of this report form is optional.

C. Public Participation

Prior to proposal, the EPA met with industry representatives several times to discuss the data and information used to develop the proposed revisions. In addition, equipment vendors, State regulatory authorities, and environmental groups had opportunity to comment on the background information that was prepared for the proposed revisions. In addition, representatives from other EPA offices and programs have been included in the regulatory development process as members of the Work Group.

The proposed revisions were published in the **Federal Register** on July 9, 1997 (62 FR 36948). The preamble to the proposed revisions discussed the availability of technical support documents, which described in detail the information gathered during the standards review. Public comments were solicited at proposal.

To provide interested persons the opportunity for oral presentation of data, views, or arguments concerning the proposed standards, a public hearing was held on August 8, 1997, at Research Triangle Park, North Carolina. However, the four scheduled speakers decided to submit written comments in place of attending the hearing, so no information was presented at the hearing.

The original public comment period was from July 9, 1997 to September 8, 1997. The EPA extended the public comment period to October 8, 1997 based on requests from commenters. During the public comment period, the EPA received 70 public comment letters on the proposed rule changes. In the post-proposal period, the EPA met with several industry representatives to learn more of their concerns regarding the proposed revisions and to gather additional information in order to respond to the public comments. Records of these contacts are found in the final rulemaking docket. All of the comments have been carefully considered, and, where determined to be appropriate by the Administrator, changes have been made in the proposed standards based on the comments received.

II. Summary of Final Rules

The final standards revise the NO_X emission limits for steam generating units in subpart Da (Electric Utility Steam Generating Units) and subpart Db (Industrial-Commercial-Institutional Steam Generating Units). Only those electric utility and industrial steam generating units for which construction, modification, or reconstruction is commenced after July 9, 1997 would be affected by these revisions.

The NO_X emission limit in the final rule for newly constructed subpart Da units is 200 nanograms per joule (ng/J_O) (1.6 lb/megawatt-hour (MWh)) gross energy output regardless of fuel type. For existing sources that become subject to subpart Da through modification or reconstruction, the NO_X emission limit is 65 ng/J_I [0.15 pounds per million BTU (lb/MMBtu)] heat input. For subpart Db units, the NO_X emission limit being promulgated is 87 ng/J_I (0.20 lb/MMBtu) heat input from the combustion of natural gas, oil, coal, or a mixture containing any of these fossil fuels; however, for low heat release rate units firing natural gas or distillate oil, the current NO_X emission limit of 43 ng/J_I (0.10 lb/MMBtu) heat input is unchanged.

Compliance with the proposed NO_X emission limit is determined on a 30-day rolling average basis, which is the same requirement that was in effect prior to the revisions. The EPA has added compliance and monitoring provisions that explain how sources are to demonstrate compliance with the output-based standards. These provisions will not increase the overall burden of sources to demonstrate compliance with the standards beyond what is already required of sources in the absence of these changes.

The revisions to the quarterly SO_2, NO_X, and opacity reporting requirements of subparts Da and Db allow electronic quarterly reports to be submitted in lieu of the written reports currently required under §§ 60.49a and 60.49b. The electronic reporting option would be available to any affected facility under subpart Da or Db, including units presently regulated under those subparts. Each electronic quarterly report would be submitted no later than 30 days after the end of the calendar quarter.

The format of the electronic report would be coordinated with the permitting authority. Each electronic report would be accompanied by a certification statement from the owner or operator indicating whether compliance with the applicable emission standards and minimum data requirements was achieved during the reporting period. Owners or operators would also be required to coordinate with their EPA Regional Office and State authority to ensure that the permitting authority agrees to receive reports in the EDR format.

The EPA has determined that acid rain continuous emissions monitoring systems (CEMS) can be used as NSPS CEMS. However, all CEMS must generate reports according to the requirements of the applicable subpart. For example, the acid rain CEMS missing data procedures are not acceptable under subpart Da. Under subpart Da, emission limits during hours of invalid data must be met according to the requirements of § 60.47a(f), which would supersede the acid rain CEMS procedures.

III. Significant Comments and Changes to the Proposed Revisions

Following is a discussion of the significant comments received on the proposed revisions and the resulting changes, if any, in the final rules. The document, "New Source Performance Standards, Subparts Da and Db—Summary of Public Comments and Responses" (EPA 453–R–98–005) contains a more detailed summary of all of the comments and responses. It also contains the explanation for minor editorial corrections made in the final revisions.

A. Performance of NO_X Control Technology

1. Selective Catalytic Reduction (SCR)

Several commenters raised concerns that the EPA's determination that SCR represents the best demonstrated technology (BDT) is not adequate. For example, commenters stated that the EPA should not consider SCR as BDT for coal-fired industrial boilers, because it has only been installed on 7 coal-fired units in the U.S., all of which are electric utility units. In addition, none of the 200 European and Japanese units with SCR cited by the EPA are industrial units. Commenters also urged that the EPA consider the potential problems associated with SCR, including costs, catalyst poisoning, and oil ash coating the catalyst, when finalizing the NSPS. Another technical issue raised was that excess SO_3 can lead to increased downstream corrosion and negative impacts on the heat rate of the unit.

Commenters also said that the relevant technologies are immature, and that EPA has insufficient data to develop a standard that fully accounts for the variabilities inherent in operating these new technologies. Other commenters added that the reported cases of successful SCR applications are extremely limited, with success being measured on the basis of short-term performance and without cost considerations.

Commenters raised similar concerns for coal-fired utility boilers. That is, they said the technology is still in the developmental phase, and there are insufficient cases where the performance of the technology has been adequately demonstrated.

The first issue raised by several of the commenters is that EPA's determination that SCR represents BDT for a range of boiler types and operating conditions is not adequate. The EPA disagrees and believes the data base that supports the BDT decision is adequate for two reasons. First, the proposal data base resulted from an extensive review of information on the available domestic and international SCR units in use in the industry at the present time. However, in response to the comments, the EPA has obtained data from three more utility boilers that utilize SCR and represent a range of operating conditions and coal types. The first utility boiler (U.S. Generating Company's Logan plant) is a 225-megawatt pulverized-coal cogeneration facility, and is operated under cycling conditions. This facility submitted 3 months of NO_X emission data to the EPA. The analysis of these data indicate that the facility is capable of achieving the input-based NO_X standard of 65 ng/J_I (0.15 lb/MMBtu) and the revised output-based standard of 200 ng/J_O (1.6 lb/MWh) gross energy output on a 30-day rolling average. (See section III.B.3 for a discussion of the development of the revised output-based standard.) The second plant is the Birchwood Power Facility, which is a 240-megawatt cogeneration facility with cycling load that began operation in 1996. Actual, short-term test results show that the facility achieves NO_X emissions of 97 ng/J_O (0.77 lb/MWh), easily attaining the NSPS output-based standard. The third facility, Stanton Energy, is a 464-megawatt utility boiler firing bituminous coal. This facility is currently meeting its permitted emission limit of 74 ng/J_I (0.17 lb/MMBtu). If this facility were to improve the performance of its SCR to 65 ng/J_I (0.15 lb/MMBtu), this facility would be capable of meeting the 200 ng/J_O (1.6 lb/MWh) output-based limit.

Second, the data base is adequate to evaluate the factors that can potentially affect SCR performance in a wide range of operating conditions. Fundamentally, like all post-combustion control devices, SCR is designed to respond to the characteristics of the stack gas. The primary difference between utility and non-utility boiler types may be that, on average, non-utility boilers may be more likely to operate with fluctuating loads. This difference in operating pattern may appear to have an impact on the characteristics of the stack gas. However, the NSPS is based on a 30-day averaging period to accommodate normal fluctuations in performance. Further, as discussed above, new analyses of two facilities that operate under cycling conditions have shown that SCR can meet the revised standard over a 30-day averaging period. The Birchwood facility reports daily cycle variations from 32 percent to 100 percent of load. The Logan facility's daily cycles ranged from 28 percent to 84 percent in the 3-month period for which data were supplied.

Another load-related technical issue raised is the difficulty in maintaining the temperatures necessary to minimize NO_X and HAP generation. In general, while designing an SCR system for a boiler, the boiler duty is taken into consideration. Specifically, the expected temperature range at the exit of the economizer is factored in the selection of an SCR catalyst formulation.

There are other steps that operators can take to ensure the desired SCR performance under variable or low load conditions. For example, if low load contributes to insufficient gas velocity to keep the flyash in suspension, the operator can add an ash hopper to divert the ash from the reactor and catalyst face. Alternatively, good ductwork system design can avoid these problems. Also, low boiler exit temperatures can be avoided by adding a economizer by-pass to keep the gas temperature higher at low loads. Finally, good flue gas mixing can overcome differences in gas flows and boiler firing conditions. Taking into consideration all of the above, in general, the EPA does not believe that SCR use is constrained by boiler duty.

Several commenters raised catalyst poisoning as an illustration that SCR is not suitable for all units. As a result of developments in catalyst technology, formulations are currently available that minimize the impact of poisoning. Nevertheless, the EPA believes this issue is really related to the cost of operating the SCR; appropriate catalyst management plans now make it possible to maximize catalyst life under plant operating conditions.

Another issue raised by commenters is that the SCR technology is immature and insufficiently demonstrated. The EPA disagrees with this comment. One recent study (Khan, S., *et al.*, "SCR Applications: Addressing Coal Characteristic Concerns." Presented at the EPRI–DOE–EPA Combined Utility Air Pollutant Control Symposium, August 1997) identified at least 212 worldwide SCR installations on coal-fired units, which cover different types of boilers subjected to varying operating conditions and firing a variety of coals. Some of these installations were designed for and have achieved high NO_X reduction levels, exceeding 90 percent. Plants in Europe have been continuously using SCR for over 10 years. Finally, SCR-equipped units located in the U.S., such as the Logan, Birchwood, and Stanton facilities, are meeting some of the most stringent NO_X limits in the country.

2. Coal-related Issues

Several commenters expressed their concern that the proposed NSPS are not adequately demonstrated for all U.S. coals, particularly medium- and high-sulfur coals. They said that German and Japanese experience with these coals is undocumented, or, in the case of Japan, is with SCRs using hot-side electrostatic precipitators (ESPs) in a low-dust environment, compared to most U.S. boilers, which use cold-side ESP's in a high-dust environment. The commenters also rejected the Department of Energy Plant Crist high-sulfur coal demonstration project because of its limited scope.

The EPA disagrees that the use of SCR for high-sulfur coal applications is unsupported. In addition to one coal-fired plant in Japan and another in Austria firing coals with sulfur contents of 2.5 percent or higher, there are two coal-fired SCR installations in the U.S. that are firing coals with sulfur contents close to 2 percent. The Northampton generating facility, which is equipped with SNCR, successfully burns waste coal, and meets some of the most stringent NO_X limits in the U.S. (0.10 lb/MMBtu). In the Plant Crist demonstration project, the catalysts from various suppliers performed successfully. Criteria for successful performance at this demonstration included ammonia slip less than 5 ppm and SO_2 oxidation less than 0.75 percent.

In view of the experience both in the U.S. and abroad, the commenters' concerns over the use of SCR for high-sulfur coal applications is unsupported. In general for these installations, design features such as low ammonia slip, a catalyst that minimizes SO_3 conversion, and an economizer bypass to maintain proper flue gas temperatures at low loads are provided.

3. Selective Noncatalytic Reduction (SNCR)

Other commenters argued that SNCR was not adequately demonstrated on fluidized bed combustion boilers (FBCs) and/or large boilers. One commenter noted that the EPA's data showed that three of the five circulating FCBs that use SNCR stated that SNCR did not work properly when the units were operated at anything less than maximum capacity. Another commenter said SNCR "has not been adequately demonstrated to work on large boilers (with a rated capacity greater than 390 MMBtu/hr), whether circulating bed or not."

Flue gas temperatures exiting the furnace can range from 1,200 °C ± 110 °C (2,200 °F ± 200 °F) at full load down to 1,040 °C ± 70 °C (1,900 °F ± 125 °F) at half load. At similar loads, temperatures can increase by as much as 30 to 60 °C (50 to 110 °F) depending on the extent of ash deposition on heat transfer surfaces. Due to these variations in the temperatures, it is often necessary to inject the reagent at different locations or levels in the upper furnace or convective pass for effective NO_X reduction. A recent publication summarized the successful retrofit of retractable lances on a 100-megawatt coal-fired utility boiler equipped with SNCR, which greatly improved low load performance. Finally, the addition of hydrogen or other hydrocarbon reducing agent can be injected with the ammonia to lower the effective temperature range. Similarly, additives can increase the temperature range of urea application. By taking these sorts of steps, the EPA believes that operators can successfully operate SNCR, even under low load conditions.

Recent analysis of NO_X emissions data from a 110-megawatt, base-loaded, circulating fluidized-bed boiler equipped with SNCR (U.S. Generating Company's Northampton plant) indicates that the facility is quite capable of meeting the proposed standard. This facility achieves average input-based emissions of 38 ng/J_I (0.089 lb/MMBtu) and output-based emissions of less than 100 ng/J_O (0.8 lb/MWh), well below the output-based standard of 200 ng/J_O (1.6 lb/MWh) gross energy output.

Regarding SNCR on large boilers, the Acid Rain Phase II NO_X Response to Comments Document (p. 212) notes that SNCR has been demonstrated on coal-fired units as large as 1,230 MMBtu/hr (Germany) and on oil-fired units as large as 2,900 MMBtu/hr (Niagara Mohawk's Oswego Station). The SNCR application on Oswego shows that injectors can effectively penetrate the combustion gas flow in large boilers. Since the effectiveness of injecting SNCR reagent into large boiler casings has been proven, and SNCR has been applied to a variety of boilers, the EPA does not see boiler size as a restriction for applying SNCR to NSPS sources.

B. Regulatory Approach

1. Fuel Neutral Approach

Several commenters supported a cap on NO_X emissions at the same level for nearly all fuel types, because it allows fuel switching as a control technology and is an "important and positive step toward cleaner air . . . across the nation." Commenters stated that currently, natural gas-fired units are subject to the most stringent standard while coal and residual oil are allowed to emit much larger quantities of NO_X. The proposed rule will remove any disincentive toward natural gas that has been created by this situation. One commenter wrote that a fuel neutral standard would not penalize any particular industry, but would encourage competition for new efficient boilers and cogeneration units, and would be consistent with the EPA's emphasis on pollution prevention.

Other commenters opposed the same NO_X emission limit for all fuel types arguing that it sets a lower than lowest achievable emission rate (LAER) and best available control technology (BACT) level for coal-fired boilers, while significantly relaxing standards for natural gas units by a factor of two to four times. Another commenter stated that a number of gas- and oil-fired units in the U.S. currently achieve approximately one-tenth of the proposed limit with the application of SCR.

Commenters stated that the "proposal violates the Act by providing an overwhelming incentive for new and modified electric generating units to burn natural gas to the exclusion of coal." Other commenters opposed the fuel neutral approach because of fuel availability and cost factors. One commenter stated that natural gas is not uniformly distributed and evenly available to all industrial users. The commenter asserted that the proposed emission limit "favors industrial development in regions that have an ample supply of natural gas and penalizes regions that have no practical option for steam production at industrial facilities other than coal."

One commenter said the fuel neutral emission rate may inadvertently be a dis-benefit to the introduction of low NO_X technology. The commenter postulated that "the result then might be continued operation of older more polluting sources than might otherwise occur."

The EPA disagrees with the commenters who contend that the fuel neutral format creates an overwhelming or disproportionate incentive to use fuels other than coal. The EPA's approach is designed to allow the continued use of coal as a fuel in those cases where it is desirable. The standard would, however, also not discourage conversion to natural gas where it makes sense in the individual application.

The EPA believes the fuel neutral approach will expand the control options available by allowing the use of clean fuels as a method for reducing NO_X emissions. Since projected new utility steam generating units are predominantly coal-fired, the use of clean fuels (i.e., natural gas) as a method of reducing NO_X emissions from these coal-fired steam generating units may give the regulated community a more cost-effective option than the application of SCR for meeting the NO_X limit. Similarly, for industrial units, the use of clean fuels as a method of reducing emissions may be a cost-effective approach for coal-fired and residual oil-fired industrial steam generating units.

The fuel neutral approach also fits well with section 101(a)(3) of the Act's emphasis on pollution prevention, which is one of the EPA's highest priorities. Because natural gas is essentially free of sulfur and nitrogen and without inorganic matter typically present in coal and oil, SO_2, NO_X, inorganic particulate, and air toxic compound emissions can be dramatically reduced, depending on the degree of natural gas use. With these environmental advantages, gas-based control techniques should be viewed as a sound alternative to flue gas treatment technologies for coal or oil burning.

Finally, the proposed amendments do not relax the existing NSPS for natural gas units. In fact, the 65 ng/J_I (0.15 lb/MMBtu) heat input reflects a 50- and 25-percent reduction in NO_X emissions over the current subpart Da limits for oil-fired and gas-fired units, respectively. Revised subpart Db would not require any additional controls for new gas-fired and distillate oil-fired units over the current NSPS because of the costs associated with additional controls. However, subpart Db does not relax the existing standards for these units either.

2. Output-Based Format to Subpart Da

Several commenters supported the output-based format of the proposed subpart Da standard, because they felt it would reward energy-efficient generators. However, other commenters opposed the format for the following reasons:

(1) The incentives to be efficient have recently increased due to the newly competitive nature of the industry, and will continue to increase without output-based standards.

(2) The format would add significant burdens to an already complicated monitoring system for utilities.

(3) There are inconsistencies between the proposed NSPS output-based format and several other input-based regulations that are also applicable to these sources.

(4) NO_X averaging of NSPS units with existing units would be very complicated.

(5) The output-based format is inappropriate and inaccurate for cogeneration facilities that produce steam in addition to or in place of electric generation. Because the customers dictate the temperature and pressure conditions of the steam that is produced, the generator has no choice and must produce the desired product. In addition, the EPA method of equating steam production to electric production was over-simplified and punitive in that it does not consider all of the potential steam production conditions, and it would increase the cost of efficient cogeneration.

(6) An output-based NSPS does not promote energy efficiency because it "makes no allowance for the use of low Btu fuels (such as waste coal) that would otherwise go unused," which would increase the costs of electrical generation and discourage national energy self-sufficiency. Further, the proposed NSPS is inconsistent with recent utility deregulation, because "an important goal of recent utility de-regulation was to allow market forces to minimize the cost of electric power to consumers, without eroding environmental protection."

The EPA continues to believe in the benefits associated with an output-based standard for new sources that encourages energy efficiency. As discussed in section III.C, however, the EPA has revised the final standard for existing sources that become subject to the NSPS because of modification or reconstruction, to be in the equivalent input-based format of 65 ng/J_I (0.15 lb/MMBtu).

The changes in the output-based format, discussed below in section III.B.3, will simplify the compliance demonstration for sources by eliminating the need to convert input values to output values. Given that the output-based format is a new regulatory approach for these sources, it is inevitable that some inconsistencies in monitoring requirements associated with various programs to which individual sources might be subject would occur. While the EPA is concerned about these apparent inconsistencies, the EPA also feels that the requirements of the NSPS stand on their own merits. The NSPS provisions do not require any new monitoring at sources that is not already required by some other program (i.e., the Acid Rain program.) However, in some instances, the Title V permit process and activities such as permit streamlining may provide relief to sources on a case-by-case basis. In addition, the EPA will continue to explore additional ways to provide monitoring relief that do not compromise the ability of EPA to adequately enforce Federal standards.

As discussed below in section III.B.3, the EPA did examine possible revisions to the steam credit allowance for cogeneration facilities. These issues are further addressed in that section.

Finally, the EPA believes that low-cost fuels can be used effectively at facilities subject to the final standards. As discussed, the U.S. Generating

Company's Northampton facility is currently performing better than would be required under the amended NSPS and uses waste coal as its sole energy source.

3. Input to Output Conversion Assumptions

The EPA revised the approach used to develop the output-based limit based on analysis of comments submitted on the input to output conversion assumptions relied on in developing the proposed standard. As discussed in detail in this section, the EPA will finalize the standard for new sources at a level of 200 ng/J_O (1.6 lb/MWh) gross energy output. The revised standard contained in this final rule is based on actual measured energy output, rather than measured heat input converted to energy output, as was the case with the proposed standard. This change addresses concerns related to overall heat rates, steam credits for cogeneration facilities, and gross versus net output. The key underlying assumption inherent in the selection of the level of the final standards at 200 ng/J_O (1.6 lb/MWh) gross output, i.e., the input-based standard of 65 ng/J_I (0.15 lb/MMBtu), is maintained.

38-Percent Baseline Efficiency. There were comments both in support of and opposed to the selection of an average 38-percent baseline boiler efficiency. The selection of a baseline efficiency value is intimately tied to the selection of a corresponding heat rate. Based on data available since the proposed standards, the Agency has been able to evaluate heat rate directly.

9,000 Btu/kWh Heat Rate. The majority of commenters opposed the selection of an assumed 9,000 Btu/kWh heat rate for use in converting input-derived NO_X emissions to an output basis. Several commenters provided examples of units that operate in the 10,000 to 11,000 Btu/kWh range. The commenters indicated that net heat rates of 10,000 to 10,500 Btu/kWh are typical of state-of-the-art units.

In light of additional data supplied by commenters and collected by EPA, the EPA has decided to revise the assumed heat rate. First, as explained later, the output-based standard is now based on gross output instead of net output, so the following discussion will be in terms of gross heat rates.

The EPA collected data from four additional utility boilers that are considered to be new and state-of-the-art from an emissions standpoint. The first boiler is a base-loaded, fluidized bed combustion cogeneration unit that fires waste coal and is equipped with SNCR (Northampton). This unit's average gross heat rate (with 50 percent credit for export steam) is less than 9,000 Btu/kWh. The second unit is a pulverized coal-fired, cogeneration unit that operates under cycling load and is equipped with SCR (Logan). This unit's average gross heat rate (with 50 percent credit for export steam) is approximately 10,250 Btu/kWh. The third utility boiler (Stanton) has an average heat rate of 10,250 Btu/kWh. The Birchwood cogeneration unit, the fourth facility, reported that they cycle between heat rates of approximately 10,700 Btu/kWh at 32 percent load and 9,000 Btu/kWh at 100 percent load. The heat rates reported by the Birchwood cogeneration unit are based on a 100 percent credit for export steam.

The EPA conducted statistical analyses in which the objective was to assess long-term NO_X emission levels, on an output basis, that can be achieved continuously. Statistically, Logan, Northampton, and Birchwood all can meet the revised output-based standard of 200 ng/J_O (1.6 lb/MWh) (gross) on a 30-day rolling average.

Cogeneration Steam Credit. Several commenters asserted that using only 50 percent of the thermal energy from the steam generated at cogeneration facilities in calculations of output-based emission rates is inappropriate. The commenters reported that the 50-percent allocation is from a section of the Public Utility Restructuring Policy Act (PURPA) in which the 50-percent thermal output is used as part of a definition of a PURPA-qualifying facility. Basing the NSPS on this factor is not justified according to the commenters. The commenters also suggested a variety of ways to calculate the steam credit including (1) converting the electric output to MMBtu plus the enthalpy of the full steam or hot water output in MMBtu, or the electric output in MWh_{el} plus the enthalpy of the full steam or hot water output in MWh_{th}, (2) measuring pounds of NO_X per million Btu of steam produced at the boiler steam header, or (3) measuring the electric output plus the full thermal output in consistent units. Another commenter suggested that since each application would differ in efficiency, credit should be given for the heat actually used and calculated on a case-by-case basis.

Other commenters insisted that efficiency should not be used as a compliance measure. The commenter explained that the efficiency calculation is an extra, unneeded step. The commenters reported that all that is needed is a CEMS to directly measure NO_X and an electric or thermal measurement for output in units of MMBtu or MWh.

As discussed, the EPA has revised the form of the final standards to be based on a direct measure of output, i.e., mass of NO_X per unit of gross energy output. In order to evaluate the data supporting the level of the standard, the EPA had to conduct data analysis to address the level of steam credit for cogeneration facilities. The EPA considered three approaches for addressing the issue of steam credit for cogeneration facilities: (1) Allow credit for steam as if it were being converted into electricity; (2) Allow credit in the form of 50 percent of the thermal value (enthalpy) of the steam; and (3) Allow credit for greater than 50 percent of the value of the steam, up to 100 percent.

The EPA decided not to allow credit for steam as if it were being converted into electricity because the EPA wants to encourage cogeneration. Allowing credit as if electricity would only provide credit for up to 38 percent of the value of the steam, which is the reported maximum of the efficiency of steam to electricity conversion.

The EPA also decided not to allow for greater than 50-percent credit for the steam. Based on analysis of heat rates for cogeneration facilities, the EPA has determined that once a facility exceeds 50 percent and approaches 100 percent credit for the steam, there is a potential for calculating an artificially high output rate, particularly if much of the steam is exported. As another option, the EPA considered allowing 100 percent credit for steam, but capping the amount of steam for which credit could be received to a certain percentage of total output. This approach was deemed to be too complex from a monitoring standpoint.

Therefore, the EPA retained the proposed 50-percent credit for export steam from cogeneration facilities on the basis that it encourages cogeneration, will not result in artificially high output rates, and will not require complex monitoring. This outcome is based on the information available to the Agency at this time. We recognize, however, that cogeneration increases the efficiency of power generation and, as discussed above, comments received during the rulemaking process indicate that there may be alternative ways of calculating the value of thermal output that warrant further consideration. We are interested in exploring alternative approaches to cogeneration and request further comment on this issue. We particularly are interested in hearing about alternatives that would allow us to determine the fraction of the energy delivered to the industrial process that is actually used and should, therefore, be included in the calculation of the gross output from cogeneration facilities.

Gross Versus Net Output. While some commenters support the use of a net output basis to the final format of the standard because it encourages energy efficiency at the facility, several other commenters raised concerns regarding how net output would actually be measured in the industry. One commenter reported that the output-based format would "require significant and costly changes to the software of monitoring and reporting systems." Other commenters reported that electrical output cannot be measured directly because it is dependent on the "electrical usage by hundreds of motors and other auxiliary equipment located throughout the plants." They claimed that net generation cannot be measured "by simply installing a wattmeter."

One commenter recommended basing the standards on gross rather than net output to account for the power drain associated with many types of control technologies. Other commenters protested that the proposal did not include a specific methodology for determining the unit net output. They said the EPA did not provide for a subsequent comment period on a "significant component" of the proposal, and the EPA should withdraw the proposal until a complete and thorough package can be provided for full public review and comment.

The EPA has reconsidered its position, and has decided to finalize the rule based on the use of gross output because of the monitoring difficulties inherent in the net output methodology. In particular, measuring net output at facilities with both affected and nonaffected units could be problematic, because a single meter on the electricity leaving the facility could not effectively allocate the electricity leaving the affected boiler. The EPA may revisit this issue should EPA develop a methodology to determine the net heat output in all circumstances.

C. Modification and Reconstruction

Commenters expressed opposition to the applicability of the NSPS to modified units. They said that Congress' intent in developing the NSPS program was to limit applicability to sources that could be designed to include state-of-the-art pollution control technology, and that the emphasis on new sources reflected Congress' recognition of the difficulty and expense of retrofitting control technology on existing sources.

One commenter said that the EPA was "acting unlawfully by failing to consider the costs that will be incurred by existing sources that become the subject of the proposed NO_X standard." The commenter proffered that existing coal-fired sources are likely to become subject to this rule eventually, unless they are specifically excluded. According to this commenter, if this occurs, the existing sources will be faced with excessive retrofit costs in order to attain the standard.

One commenter stated that "the installation of SCR on existing units * * * would be economically infeasible." A possible solution proposed by a commenter was that the EPA propose a standard that modified units could meet without SCR, or justify the use of the same standards as for new units. One commenter reasoned that "since EPA states that few modified sources will be affected, adding specific language clarifying that such units are not subject to the NSPS would raise few, if any, policy implications." Another possible solution presented was that the EPA specifically exclude modified boilers from the final NSPS.

One commenter stated that the proposed NO_X emission limit was not demonstrated for non-gas-fired modified sources and that the new limit should not apply to sources that come under the NSPS through modification. In situations where liquid or solid fuel is fired, it is not always possible or reasonable to comply with the proposed limit. For instance, the commenter has a residual oil-fired boiler that could not be retrofitted to meet the proposed standard, and add-on controls would not be feasible because of limited space and unreasonable cost.

One commenter said EPA is aggressively pursuing businesses that have made efficiency improvements to force the units to meet NSPS under the modification provisions in 40 CFR part 60. The commenter stated that the EPA "clearly has the discretion and duty to distinguish between new and existing sources which become subject to this rule."

The Clean Air Act defines a modification as "any physical change in, or change in the method of operation of, a stationary source which increases the amount of any air pollutant emitted by such source or which results in the emission of any air pollutant not previously emitted." (Section 111(a)(4)) Section 60.14 of the subpart A General Provisions provides additional guidance on EPA's interpretation of this definition, and specifically excludes changes in ownership of an existing facility from being considered a modification. (40 CFR 60.14) In addition, a key aspect to the definition of modification is that the change to the facility must result in an emissions increase.

Section 111(b)(1)(B) of the Act requires the Administrator to promulgate standards of performance for "new sources" in each category of sources which in the Administrator's judgment causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare. Section 111(a)(2) of the Act defines "new source" to include stationary sources which are modified after an applicable standard of performance is proposed. The EPA finds nothing in the comments that would justify ignoring this clear statutory mandate. In developing standards of performance, section 111(a)(1) of the Act does, however, allow the Administrator to take into consideration the cost of achieving the required reduction and any nonair quality health and environmental impact and energy requirements. As noted at proposal, the efficiency of most existing electric utility steam generating plants ranges from 24- to 38-percent efficient. The EPA selected 38-percent efficiency as the baseline reflective of NSPS units. The EPA believes that selecting the 38-percent efficiency level for new electric utility steam generating units was an appropriate exercise of its discretion based on the available information. The EPA realizes, however, that existing units are likely to operate in the lower end of this range, with higher associated heat rates, which would make it more difficult to meet an output-based standard. These sources would have to compensate with higher control device performance (up to a 40-percent increase in performance), which would be more costly. To ease this potential burden, the EPA has decided to allow any existing units that become subject to the NSPS as a result of undergoing a modification or reconstruction to meet the equivalent input-based standard of 65 ng/J_I (0.15 lb/MMBtu) on which the output-based standard applicable to new units is based. This change will eliminate the concern that higher average heat rates at existing units could adversely affect a source's ability to meet an output-based standard. This level of control represents the same overall level of SCR performance that would be required of new units, but lacks the benefits attributed to promoting energy efficiency that the output-based format provides.

D. Applicability and Exemptions

1. Gas Turbines

Commenters stated that the EPA should not apply the proposed standard to modified and reconstructed waste heat boilers. The commenters said these waste heat systems are typically installed in the ductwork of a gas turbine exhaust and are not amenable to significant modification for NO_X control because of their configuration. According to the commenters, tubes are tightly packed, space for reconfiguration is extremely limited, and possible back pressure impacts on the upstream device are a major concern. Applying the NSPS would require the combined system to meet the new standard, because the NO_X from the upstream device (i.e., combustion turbine) cannot be separated from the steam generator NO_X for purposes of add-on control. The commenters said that add-on controls are not demonstrated for such systems.

The systems described by the commenters would be subject to subpart GG of this part, standards of performance for stationary gas turbines, and subparts Da or Db. Because these standards cover separate emission sources, continued applicability of subparts Da or Db is needed. However, the EPA's ongoing Industrial Combustion Coordinated Rulemaking (ICCR) could result in the EPA extending the applicability of subpart GG to the duct burner, which is currently covered by subparts Da and Db. The EPA agrees that if this were to occur, the ICCR-driven revisions to subpart GG would pose a potential conflict with the subparts Da and Db. Therefore, the EPA will revise subparts Da and Db to exempt sources that may also become subject to subpart GG, should such revisions to subpart GG occur.

2. Ten-Percent Exemption

Commenters noted that the proposed revision appears to apply to all steam generating units, including units that are excluded from the current standard because they fire 10 percent or less fossil fuel. The commenters did not believe that the EPA intended that the revised NO_X limit should apply to facilities that combust a limited amount of fossil fuel. Several commenters suggested clarifying the following language at the end of § 60.44b(l)(1): "* * * 86 ng/J (0.20 lb/MMBtu) heat input unless the affected facility has an annual capacity factor for coal, oil, and natural gas of 10 percent (0.10) or less and is subject to a federally enforceable requirement that limits operation of the facility to an annual capacity factor of 10 percent (0.10) or less for coal, oil, and natural gas; or * * *."

The EPA did not intend to remove the 10-percent exemption from the revised NSPS. The EPA will add the suggested regulatory language to clarify that this exemption still applies.

3. Municipal Waste Combustors

Commenters pointed out that, as written, the proposed NO_X revisions would include municipal solid waste combustors (MWC) that only use a limited amount of fossil fuels for startup purposes and supplemental fuel during those periods when the heat content of the waste is low, in order to maintain good combustion conditions. These units are already subject to subpart Eb of this part, the revised NSPS for large MWC. The commenters suggested that the addition of the 10-percent exemption, discussed above, would alleviate this concern or that exemptions for MWC units subject to the relevant MWC rules would make sense.

As discussed above, the EPA has included the language regarding the 10-percent exemption to the final rule, which should cover these types of sources. In addition the EPA will revise the final rule to exempt units that are subject to subpart Eb to avoid any possible conflicts.

E. Monitoring

Several commenters requested that the EPA clarify and expand the allowance of the use of part 75 CEMS in place of the subparts Da and Db required monitoring provisions. In particular, commenters requested that part 75 elements such as data validation procedures, CEMS configuration specifications, and methods of compliance determination should be deemed to satisfy subparts Da and Db monitoring provisions.

In the past, the EPA determined that Acid Rain CEMS can be used as NSPS Subpart Da CEMS. That determination is available on the Office of Enforcement and Compliance Assurances's web site. A subpart Db boiler equipped with an acid rain CEMS can also use this CEMS as a subpart Db CEMS. In either case, the reports generated by this CEMS must be generated according to the provisions of subparts Da or Db, as applicable, and submitted to the authority in charge of the NSPS program, because the NSPS and acid rain programs have different requirements and are managed by different authorities.

Regarding data validation procedures, the EPA headquarters already maintains the acid rain data base and the AIRS data base, which is suitable for reports from non-acid rain programs. In addition, several States maintain their own data bases. The EPA believes that the data validation issue should not lead to any conflicts considering that the acid rain and the subparts Da and Db report formats must follow their own requirements. The EPA headquarters has addressed a few span-related issues upon request and will continue this practice under the part 60 General Provisions. Finally, emission limits during hours of invalid data must be met using other means than CEMS data according to the requirements of § 60.47a(f) or § 60.48b(f), as applicable.

The EPA has added language to § 60.47a(c) to clarify that "If the owner or operator has installed a nitrogen oxides emission rate continuous emission monitoring system (CEMS) to meet the requirements of part 75 of this chapter and is continuing to meet the ongoing requirements of part 75 of this chapter, that CEMS may be used to meet the requirements of this section, except that the owner or operator shall also meet the requirements of § 60.49a. Data reported to meet the requirements of § 60.49a shall not include data substituted using the missing data procedures in subpart D of part 75 of this chapter, nor shall the data have been bias adjusted according to the procedures of part 75 of this chapter. Similar language has also been added to § 60.48b(b) to clarify the use of part 75 CEMS with subpart Db affected facilities.

IV. Administrative Requirements

A. Docket

This final rulemaking action is subject to section 307(d) of the Act. Accordingly, the EPA has established a docket (No. A–91–71), which consists of an organized and complete file of all information submitted to, or otherwise considered by, the EPA in the development of this action. The docket includes all memoranda and studies cited by the EPA in this preamble. The principal purposes of the docket are: (1) To allow interested parties a means to identify and locate documents so that they can effectively participate in the rulemaking process, and (2) to serve as the record in case of judicial review. The docket is available for public inspection at EPA's Air Docket, which is listed under the ADDRESSES section of this document.

B. Office of Management and Budget (OMB) Review

1. Paperwork Reduction Act

These revisions contain no changes to the information collection requirements of the current NSPS that would increase the burden to sources, and the currently approved Office of Management and Budget (OMB) information collection requests are still in force for the amended rules. These information collection requests are identified as number 1053.05, OMB 2060–0023, for 40 CFR 60.40a–49a and number 1088.08, OMB 2060–0072 for 40 CFR 60.40b-49b. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Some changes in the rule, such as allowing the submittal of electronic reports, are provided as an option to sources, and should reduce burden to those sources electing to use this report format. Other rule changes, such as the difference in numerical NO_X emission limits and the output-based format of the standard, do not result in additional recordkeeping and reporting requirements, beyond those already required by other programs such as the Acid Rain requirements in part 75.

2. Executive Order 12866

Under Executive Order 12866 (58 FR 51735, Oct. 4, 1994), the Agency must determine whether the regulatory action is "significant" and, therefore, subject to OMB review and the requirements of the Executive Order. The Order defines "significant" regulatory action as one that is likely to lead to a rule that may: (1) have an annual effect on the economy of $100 million or more, or adversely and materially affect a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligation of recipients thereof; (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, the EPA has determined that this rule is a "significant regulatory action" because this action may have an annual effect on the economy of $100 million or more and it raises novel policy issues, such as the output-based format of the subpart Da emission limit for new sources and the fuel neutral approach to the emission limits under both subparts. As such, this action was submitted to OMB for review. Changes made in response to OMB suggestions or recommendations will be documented in the public record.

C. Unfunded Mandates Reform Act

Under section 202 of the Unfunded Mandates Reform Act of 1995 ("UMRA"), signed into law on March 22, 1995, the EPA must prepare a statement to accompany any proposed rule where the estimated costs to State, local, or tribal governments, or to the private sector, will be $100 million or more in any one year. Under section 205, the EPA must select the most cost-effective, least costly, or least burdensome alternative that achieves the objective of the rule and is consistent with statutory requirements. Section 203 requires the EPA to establish a plan for informing and advising any small governments that may be significantly impacted by the rule.

The unfunded mandates statement under section 202 must include: (1) A citation of the statutory authority under which the rule is proposed; (2) an assessment of the costs and benefits of the rule, including the effect of the mandate on health, safety and the environment, and the federal resources available to defray the costs; (3) where feasible, estimates of future compliance costs and disproportionate impacts upon particular geographic or social segments of the nation or industry; (4) where relevant, an estimate of the effect on the national economy; and, (5) a description of the EPA's prior consultation with State, local, and tribal officials.

Since this final rule is estimated to impose costs to the private sector in excess of $100 million, the EPA has prepared the following statement with respect to these impacts.

1. Statutory Authority

The statutory authority for this rulemaking is identified and described in section I.A of the preamble. As required by section 205 of the UMRA, and as described more fully in the proposal preamble (62 FR 36948, section III) and section III of this preamble, the EPA has chosen to promulgate a rule that is the least burdensome alternative for regulation of these sources that meets the statutory requirements under the Act.

2. Costs and Benefits

As described in section VI of the proposal preamble, the estimate of annual social cost for the regulation is $40 million for utility boilers and $41 million for industrial boilers in the year 2000. Certain simplifying assumptions, such as no fuel switching in response to the rule, may have resulted in a significant overestimation of these costs.

The pollution control costs will not impose direct costs for State, local, and tribal governments. Indirectly, these entities face increased costs in the form of higher prices for electricity and the goods produced in the facilities requiring new industrial boilers that would be subject to this final rule. There are no federal funds available to assist State, local, or tribal governments with these indirect costs.

Because this regulation affects boilers as they are constructed (or modified), the emission reductions attributable to the regulation increase year by year until all existing boilers have been replaced. In the year 2000, the NO_X emission reduction relative to the baseline for utility boilers is estimated to be 26,000 tons per year. In the year 2000, the NO_X emission reduction relative to the baseline for industrial boilers that represent net additions to existing capacity is estimated to be 20,000 tons per year. Emissions reductions from replacement boilers are not quantified because of difficulties in characterizing emission rates for the boilers being replaced and the inability of the replacement model to predict selection of different types of boilers in both the baseline case and in response to the regulation. A qualitative analysis of industrial boiler replacement raises the possibility that replacement delay due to the revision may keep some boilers continuing to emit at a higher level than they would in the baseline case where they would be replaced by a lower emitting boiler.

Reducing emissions of NO_X has the potential to benefit society in a number of ways. Emissions of NO_X result in a wide range of damages, ranging from human health effects to impacts on ecosystems. They not only contribute to ambient levels of potentially harmful nitrogen compounds, but they also have important precursor effects. In combination with volatile organic compounds (VOCs), they contribute to the formation of ground level ozone. Along with emissions of sulfur oxides, they are also precursors to particulate matter and acidic deposition.

See Table 2 for a summary of linkages between NO_X emissions and damage categories.

TABLE 2.—LINKAGES BETWEEN NO_X EMISSIONS AND DAMAGE CATEGORIES: STRENGTH OF THE EVIDENCE

	Direct effects	Precursor effects		
	Ambient NO_X levels	Ambient ozone levels	Ambient particulate matter	Acid deposition
Human Health:				
Acute Morbidity	√√√	√√√	√√√	√
Chronic Morbidity	√√	√	√√√	
Mortality	....	√	√√√	....
Ecosystems:				
Terrestrial	√√ [1]	√√	√√	....
Aquatic	√√	....	....	√√√
Commercial Biological Systems [2]:				
Agriculture	√	√√√	....	....
Forestry	....	√√	....	√
Visibility	√√	....	√√√	....
Materials	√√√	....	√√√	....

√ = weak evidence.
√√ = limited evidence.
√√√ = strong evidence.
[1] Evidence indicates that NO_X can have both positive and negative effects in this category.
[2] Evidence for this category relates specifically to certain commercial crop or tree types rather than to the more general terrestrial damages that are covered in the separate ecosystems category.

Benefits are only qualitatively addressed in the regulatory impacts analysis (RIA) because of difficulties in physically locating the not yet built boilers and translating their emission reductions into changes in ambient concentrations of nitrogen compounds, ozone concentrations, and particulate matter concentrations.

3. Future and Disproportionate Costs

The rule is not expected to have any disproportionate budgetary effects on any particular region of the nation, any State, local, or tribal government, or urban or rural or other type of community. Only very small increases in electricity prices are estimated. See section VIII C.4 of the proposal preamble for more detail.

4. Effects on National Economy

Significant effects on the national economy from this rule are not anticipated. See section VIII.C.4 of the proposal preamble for more detail.

5. Consultation with Government Officials

The UMRA requires that EPA describe the extent of the Agency's prior consultation with affected State, local, and tribal officials, summarize the officials' comments or concerns, and summarize the EPA's response to those comments or concerns. In addition, section 203 of the Act requires that the EPA develop a plan for informing and advising small governments that may be significantly or uniquely impacted by a proposal.

In the development of this rule, the EPA has provided small governments (State, local, and tribal) the opportunity to comment on this regulatory program. A fact sheet which summarized the regulatory program, the control options being considered, preliminary revisions, and the projected impacts was forwarded to seven trade associations representing State, local, and tribal governments. A meeting was held for interested parties to discuss and provide comments on the program. Written comments also were requested. The main comments received dealt with the need to consider the impacts of the revisions on small units and facilities. Commenters also stated that the requirement for an integrated resource plan is unnecessary and burdensome for small operators and may constitute an unfunded mandate. In response to this concern, the EPA removed the requirement for an integrated resource plan from this rulemaking. In response to the concern regarding the cost impacts on small industrial steam generating units, the EPA proposed a higher NO_X emission limit for industrial units than it proposed for utility units. The revised limit for industrial units effectively results in no additional controls for gas and distillate oil-fired industrial units over that required to comply with the current emission limits. As described in sections VIII.D.3 and D.4.c of the proposal preamble, the impacts on small businesses and governments have been analyzed and indicate that small governments are not significantly impacted by this rule and thus no plan is required. Public comments received from government entities were largely limited to technical comments on the proposed revisions. However, the City of Tampa, Florida, did raise a burden-related issue due to concerns regarding the potential overlap in applicability between subpart Db and other NSPS provisions affecting municipal waste combustors. As described in section III.D.3, the EPA has addressed their concerns by reinstating the 10-percent exemption and by specifically exempting MWC units from applicability to subpart Db.

D. Executive Order 12875

Under Executive Order 12875, EPA may not issue a regulation that is not required by statute and that creates a mandate upon a State, local or tribal government, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by those governments. If the mandate is unfunded, EPA must provide to OMB a description of the extent of EPA's prior consultation with representatives of affected State, local and tribal governments, the nature of their concerns, copies of any written communications from the governments, and a statement supporting the need to issue the regulation. In addition, Executive Order 12875 requires EPA to develop an effective process permitting elected officials and other representatives of State, local and tribal governments "to provide meaningful and timely input in the development of regulatory proposals containing significant unfunded mandates."

The EPA has concluded that this rule may create a mandate on State, local, and/or tribal governments and that the Federal government will not provide the funds necessary to pay the direct costs incurred by the State, local and/or tribal governments in complying with the mandate. These governments will also have the responsibility to carry out the rule by incorporating it into permits and enforcing it, as delegated. They will collect permit fees that pay for the costs of applying the rule.

In developing this rule, EPA consulted with these governments to enable them to provide meaningful and timely input in the development of this rule. As discussed in section IV.C.5 of this preamble, EPA provided numerous opportunities for these stakeholders to comment on the proposed amendments and has carefully considered their input.

As described in sections IV.C.2 and IV.C.3, EPA does not expect this rule to impose direct compliance costs on State, local, and tribal governments. At most, these entities will face increased indirect costs in the form of slightly higher prices for electricity and the goods produced in facilities requiring new industrial boilers that would be subject to this final rule. Compared to the estimated health and environmental benefits, described in section IV.C.2 of this preamble, EPA believes the need to issue this final rule outweighs the potential costs to these governmental entities.

E. Executive Order 13084

Under Executive Order 13084, EPA may not issue a regulation that is not required by statute, that significantly or uniquely affects the communities of Indian tribal governments, and that imposes substantial direct compliance costs on those communities, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by the tribal governments. If the mandate is unfunded, EPA must provide to OMB, in a separately identified section of the preamble to the rule, a description of the extent of EPA's prior consultation with representatives of affected tribal governments, a summary of the nature of their concerns, and a statement supporting the need to issue the regulation. In addition, Executive Order 13084 requires EPA to develop an effective process permitting elected and other representatives of Indian tribal governments "to provide meaningful and timely input in the development of regulatory policies on matters that significantly or uniquely affect their communities."

Today's rule does not significantly or uniquely affect the communities of Indian tribal governments. The EPA received extensive public comments on the proposed amendments. None of the commenters raised any issues of direct significance to Indian tribal governments. Accordingly, the requirements of section 3(b) of Executive Order 13084 do not apply to this rule.

F. Regulatory Flexibility Act

EPA has determined that it is not necessary to prepare a regulatory flexibility analysis in connection with this final rule. EPA has also determined that this rule will not have a significant economic impact on a substantial number of small entities. The Regulatory Flexibility Act (RFA) requires EPA to give special consideration to the impact of regulation on small businesses, small organizations, and small governmental units. The major purpose of the RFA is to keep paperwork and regulatory requirements from getting out of proportion to the scale of the entities being regulated, without compromising the objectives of, in this case, the Clean Air Act. The RFA specifies that the EPA must prepare an initial regulatory flexibility analysis if a proposed regulation will have a significant economic impact on a substantial number of small entities.

Firms in the electric services industry (SIC 4911) are classified as small by the U.S. Small Business Administration if the firm produces less than four million megawatts a year. For the time period of the analysis (1996 to 2000), one projected new utility boiler may be affected and small. Of the 13 projected new utility boilers, 10 are known to not be small, and 2 of the remaining 3 are not expected to incur additional control costs due to the regulation. The size of the owning entity is unknown for the remaining utility boiler. That boiler also has the smallest cost in mills/kWh (0.07) of the 11 projected units to have additional control costs. Therefore, no significant small business impacts are anticipated for the utility boilers.

Regarding industrial boilers, EPA expects that some small businesses may face additional pollution control costs. It is difficult to project the number of industrial steam generating units that will both incur control costs under the regulation and be owned by a small entity. Since the rule only affects new sources, and plans for new industrial boilers are not available (as they are for electric utilities), linking new projected boilers to size of owning entity is difficult. The projection of 381 new boilers has 293 of the boilers incurring no costs because they are projected to be either gas-fired or distillate-oil-fired units that would require no additional control. Some of the 88 remaining boilers which are projected to incur costs in complying with the regulation may be owned by small entities. The size of the owning entity and the size of the boiler are not related in any simple way, but smaller entities may be more likely to have a smaller boiler. The applicability size cut off of 100 million Btu/hour heat input for industrial boilers would be expected to result in fewer small entities being affected. Since only 88 industrial boilers are expected to incur any costs and many of them are likely to be owned by large entities, the EPA projects that fewer than 88 of these boilers will be owned by small entities.

The information used for economic impact analysis for the proposed rule matches boiler size and fuel type to various industries. These data overestimate the share of boilers that are residual-oil-fired and coal-fired, but the data are nonetheless useful for estimating the potential economic impact of the rule on small entities in terms of cost-to-sales ratio. This analysis estimates costs as a percent of value of shipments (closely related to sales) for affected facilities. The average control cost as a percentage of value of shipments for all affected facilities is 0.07 percent. The range of average control cost across industries varies from a low of 0.004 percent for primary metals to a high of 0.8 percent for the paper industry. Although the cost varies by industry, boiler size, and fuel, it is unlikely that any affected small entities will have a control cost to sales ratio of greater than one percent.

G. Executive Order 13045

Executive Order 13045 applies to any rule that EPA determines (1) economically significant as defined under Executive Order 12866, and (2) the environmental health or safety risk addressed by the rule has a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned rule on children and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

This final rule is not subject to Executive Order 13045, entitled Protection of Children from Environmental Health Risks and Safety Risks (62 FR 19885, April 23, 1997), because it does not involve decisions on environmental health risks or safety risks that may disproportionately affect children.

H. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA) directs all Federal agencies to use voluntary consensus standards instead of government-unique standards in their regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., material specifications, test methods, sampling and analytical procedures, business practices, etc.) that are developed or adopted by one or more voluntary consensus standards bodies. Examples of organizations generally regarded as voluntary consensus standards bodies include the American Society for Testing and Materials (ASTM), the National Fire Protection Association (NFPA), and the Society of Automotive Engineers (SAE). The NTTAA requires Federal agencies like EPA to provide Congress, through OMB, with explanations when an agency decides not to use available and applicable voluntary consensus standards.

This action does not involve any new technical standards or the incorporation by reference of existing technical standards. Therefore, consideration of voluntary consensus standards is not relevant to this action.

I. Congressional Review Act

The Congressional Review Act, 5 U.S.C. 801 *et seq.*, as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. The EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the **Federal Register**. This action is a "major rule" as defined by 5 U.S.C. 804(2).

J. Clean Air Act Procedural Requirements

1. Administrator's Listing—Section 111

As prescribed by section 111(b)(1)(A) of the Act, establishment of standards of performance for electric utility steam generating units and industrial-commercial-institutional steam generating units was preceded by the Administrator's determination that these sources contribute significantly to air pollution which may reasonably be anticipated to endanger public health or welfare.

2. Periodic Review—Section 111

This regulation will be reviewed again 8 years from the date of promulgation of these revisions to the standard. The review will include an assessment of the need for integration with other programs, enforceability, improvements in emission control technology, and reporting requirements.

3. External Participation—Section 117

In accordance with section 117 of the Act, publication of this review was preceded by consultation with independent experts. The Administrator has considered comments on several aspects of the proposed revisions, including economic and technical issues.

4. Economic Impact Analysis—Section 317

Section 317 of the Act requires the EPA to prepare an economic impact assessment for any emission standards under section 111 of the Act. An economic impact assessment was prepared for the proposed revision to the standards. In the manner described above under the discussions of the impacts of, and rationale for, the proposed revision to the standards, the EPA considered all aspects of the assessments in promulgating the revision to the standards. The economic impact assessment is included in the docket listed at the beginning of this document under **SUPPLEMENTARY INFORMATION.**

Statutory Authority

The statutory authority for this rule is provided by sections 101, 111, 114, 301, and 407 of the Clean Air Act, as Amended; 42 U.S.C. 7401, 7411, 7414, 7601, and 7651f.

List of Subjects in 40 CFR Part 60

Environmental protection, Air pollution control, Electric utility steam generating units, Industrial-commercial-institutional steam generating units, Intergovernmental relations, Reporting and recordkeeping requirements.

Dated: September 3, 1998

Carol M. Browner,

Administrator.

For the reasons set out in the preamble, title 40, chapter 1 of the Code of Federal Regulations is amended as follows.

PART 60—[AMENDED]

1. The authority citation for part 60 continues to read as follows:

Authority: 42 U.S.C. 7401, 7411, 7413, 7414, 7416, 7601, and 7602.

Subpart Da—[Amended]

2. Section 60.40a is amended by revising paragraph (b) to read as follows:

§ 60.40a Applicability and designation of affected facility.

* * * * *

(b) Unless and until subpart GG of this part extends the applicability of subpart GG of this part to electric utility steam generators, this subpart applies to electric utility combined cycle gas turbines that are capable of combusting more than 73 megawatts (250 million Btu/hour) heat input of fossil fuel in the steam generator. Only emissions resulting from combustion of fuels in the steam generating unit are subject to this subpart.

(The gas turbine emissions are subject to subpart GG of this part.)

* * * * *

3. Section 60.41a is amended by adding a definition for "Gross output" in alphabetical order to read as follows:

§ 60.41a Definitions.

* * * * *

Gross output means the gross useful work performed by the steam generated. For units generating only electricity, the gross useful work performed is the gross electrical output from the turbine/generator set. For cogeneration units, the gross useful work performed is the gross electrical output plus one half the useful thermal output (i.e., steam delivered to an industrial process).

* * * * *

4. Section 60.44a is amended by revising paragraphs (a) introductory text and (c) introductory text and by adding paragraph (d) to read as follows:

§ 60.44a Standard for nitrogen oxides.

(a) On and after the date on which the initial performance test required to be conducted under § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility, except as provided under paragraphs (b) and (d) of this section, any gases which contain nitrogen oxides (expressed as NO_2) in excess of the following emission limits, based on a 30-day rolling average:

* * * * *

(c) Except as provided under paragraph (d) of this section, when two or more fuels are combusted simultaneously, the applicable standard is determined by proration using the following formula:

* * * * *

(d)(1) On and after the date on which the initial performance test required to be conducted under § 60.8 is completed, no new source owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility for which construction commenced after July 9, 1997 any gases which contain nitrogen oxides (expressed as NO_2) in excess of 200 nanograms per joule 1.6 pounds per megawatt-hour) gross energy output, based on a 30-day rolling average.

(2) On and after the date on which the initial performance test required to be conducted under § 60.8 is completed, no existing source owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility for which modification or reconstruction commenced after July 9, 1997 any gases which contain nitrogen oxides (expressed as NO_2) in excess of 65 ng/ J_I (0.15 pounds per million Btu) heat input, based on a 30-day rolling average.

5. Section 60.46a is amended by adding paragraph (i) to read as follows:

§ 60.46a Compliance provisions.

* * * * *

(i) *Compliance provisions for sources subject to § 60.44a(d).* (1) The owner or operator of an affected facility subject to § 60.44a(d)(1) (new source constructed after July 7, 1997) shall calculate NO_X emissions by multiplying the average hourly NO_X output concentration measured according to the provisions of § 60.47a(c) by the average hourly flow rate measured according to the provisions of § 60.47a(l) and divided by the average hourly gross heat rate measured according to the provisions of § 60.47a(k).

(2) The owner or operator of an affected facility subject to § 60.44a(d)(2) (modified or reconstructed source after July 7, 1997) shall demonstrate compliance according to the provisions of paragraph (g) of this section.

6. Section 60.47a is amended by revising paragraph (c) and by adding paragraphs (k) and (l) to read as follows:

§ 60.47a Emission monitoring.

* * * * *

(c)(1) The owner or operator of an affected facility shall install, calibrate, maintain, and operate a continuous monitoring system, and record the output of the system, for measuring nitrogen oxides emissions discharged to the atmosphere; or

(2) If the owner or operator has installed a nitrogen oxides emission rate continuous emission monitoring system (CEMS) to meet the requirements of part 75 of this chapter and is continuing to meet the ongoing requirements of part 75 of this chapter, that CEMS may be used to meet the requirements of this section, except that the owner or operator shall also meet the requirements of § 60.49a. Data reported to meet the requirements of § 60.49a shall not include data substituted using the missing data procedures in subpart D of part 75 of this chapter, nor shall the data have been bias adjusted according to the procedures of part 75 of this chapter.

* * * * *

(k) The procedures specified in paragraphs (k)(1) through (k)(3) of this section shall be used to determine gross heat rate for sources demonstrating compliance with the output-based standard under § 60.44a(d)(1).

(1) The owner or operator of an affected facility with electricity generation shall install, calibrate, maintain, and operate a wattmeter; measure gross electrical output in megawatt-hour on a continuous basis; and record the output of the monitor.

(2) The owner or operator of an affected facility with process steam generation shall install, calibrate, maintain, and operate meters for steam flow, temperature, and pressure; measure gross process steam output in joules per hour (or Btu per hour) on a continuous basis; and record the output of the monitor.

(3) For affected facilities generating process steam in combination with electrical generation, the gross energy output is determined from the gross electrical output measured in accordance with paragraph (k)(1) of this section plus 50 percent of the gross thermal output of the process steam measured in accordance with paragraph (k)(2) of this section.

(l) The owner or operator of an affected facility demonstrating compliance with the output-based standard under § 60.44a(d)(1) shall, install, certify, operate, and maintain a continuous flow monitoring system, and record the output of the system, for measuring the flow of exhaust gases discharged to the atmosphere.

7. Section 60.49a is amended by revising the first sentence of paragraph (i) and adding paragraph (j) to read as follows:

§ 60.49a Reporting requirements.

* * * * *

(i) Except as provided in paragraph (j) of this section, the owner or operator of an affected facility shall submit the written reports required under this section and subpart A of this part to the Administrator for every calendar quarter. * * *

(j) The owner or operator of an affected facility may submit electronic quarterly reports for SO_2 and/or NO_X and/or opacity in lieu of submitting the written reports required under paragraphs (b) and (h) of this section. The format of each quarterly electronic report shall be coordinated with the permitting authority. The electronic report(s) shall be submitted no later than 30 days after the end of the calendar quarter and shall be accompanied by a certification statement from the owner or operator, indicating whether compliance with the applicable emission standards and minimum data requirements of this subpart was achieved during the reporting period. Before submitting reports in the electronic format, the owner or operator shall coordinate with the permitting authority to obtain their agreement to submit reports in this alternative format.

Subpart Db—[Amended]

8. Section 60.40b is amended by adding paragraphs (h) and (i) to read as follows:

§ 60.40b Applicability and delegation of authority.

* * * * *

(h) Affected facilities which meet the applicability requirements under subpart Eb (Standards of performance for municipal waste combustors; § 60.50b) are not subject to this subpart.

(i) Unless and until subpart GG of this part is revised to extend the applicability of subpart GG of this part to steam generator units subject to this subpart, this subpart will continue to apply to combined cycle gas turbines that are capable of combusting more than 29 MW (100 million Btu/hour) heat input of fossil fuel in the steam generator. Only emissions resulting from combustion of fuels in the steam generating unit are subject to this subpart. (The gas turbine emissions are subject to subpart GG of this part.)

9. Section 60.44b is amended by revising paragraphs (a) introductory text, (b) introductory text, (c), and (e) introductory text and by adding paragraph (l) to read as follows:

§ 60.44b Standard for nitrogen oxides.

(a) Except as provided under paragraphs (k) and (l) of this section, on and after the date on which the initial performance test is completed or is required to be completed under § 60.8 of this part, whichever date comes first, no owner or operator of an affected facility that is subject to the provisions of this section and that combusts only coal, oil, or natural gas shall cause to be discharged into the atmosphere from that affected facility any gases that contain nitrogen oxides (expressed as NO_2) in excess of the following emission limits:

* * * * *

(b) Except as provided under paragraphs (k) and (l) of this section, on and after the date on which the initial performance test is completed or is required to be completed under § 60.8 of this part, whichever date comes first, no owner or operator of an affected facility that simultaneously combusts mixtures of coal, oil, or natural gas shall cause to be discharged into the atmosphere from that affected facility any gases that contain nitrogen oxides in excess of a limit determined by the use of the following formula:

* * * * *

(c) Except as provided under paragraph (l) of this section, on and after the date on which the initial performance test is completed or is required to be completed under § 60.8 of this part, whichever date comes first, no owner or operator of an affected facility that simultaneously combusts coal or oil, or a mixture of these fuels with natural gas, and wood, municipal-type solid waste, or any other fuel shall cause to be discharged into the atmosphere any gases that contain nitrogen oxides in excess of the emission limit for the coal or oil, or mixtures of these fuels with natural gas combusted in the affected facility, as determined pursuant to paragraph (a) or (b) of this section, unless the affected facility has an annual capacity factor for coal or oil, or mixture of these fuels with natural gas of 10 percent (0.10) or less and is subject to a federally enforceable requirement that limits operation of the affected facility to an annual capacity factor of 10 percent (0.10) or less for coal, oil, or a mixture of these fuels with natural gas.

* * * * *

(e) Except as provided under paragraph (l) of this section, on and after the date on which the initial performance test is completed or is required to be completed under § 60.8 of this part, whichever date comes first, no owner or operator of an affected facility that simultaneously combusts coal, oil, or natural gas with byproduct/waste shall cause to be discharged into the atmosphere any gases that contain nitrogen oxides in excess of the emission limit determined by the following formula unless the affected facility has an annual capacity factor for coal, oil, and natural gas of 10 percent (0.10) or less and is subject to a federally enforceable requirement that limits operation of the affected facility to an annual capacity factor of 10 percent (0.10) or less:

* * * * *

(l) On and after the date on which the initial performance test is completed or is required to be completed under § 60.8 of this part, whichever date comes first, no owner or operator of an affected facility which commenced construction, modification, or reconstruction after July 9, 1997 shall cause to be discharged into the atmosphere from that affected facility any gases that contain nitrogen oxides (expressed as NO_2) in excess of the following limits:

(1) If the affected facility combusts coal, oil, or natural gas, or a mixture of these fuels, or with any other fuels: A limit of 86 ng/J_I (0.20 lb/million Btu) heat input unless the affected facility has an annual capacity factor for coal, oil, and natural gas of 10 percent (0.10) or less and is subject to a federally enforceable requirement that limits operation of the facility to an annual capacity factor of 10 percent (0.10) or less for coal, oil, and natural gas; or

(2) If the affected facility has a low heat release rate and combusts natural gas or distillate oil in excess of 30 percent of the heat input from the combustion of all fuels, a limit determined by use of the following formula:

$$E_n = [(0.10 * H_{go})+(0.20 * H_r)]/(H_{go}+H_r)$$

Where:

E_n is the NO_X emission limit, (lb/million Btu),

H_{go} is the heat input from combustion of natural gas or distillate oil, and

H_r is the heat input from combustion of any other fuel.

10. Section 60.48b is amended by revising paragraph (b) to read as follows:

§ 60.48b Emission monitoring for particulate matter and nitrogen oxides.

* * * * *

(b) Except as provided under paragraphs (g), (h), and (i) of this section, the owner or operator of an affected facility shall comply with either paragraphs (b)(1) or (b)(2) of this section.

(1) Install, calibrate, maintain, and operate a continuous monitoring system, and record the output of the system, for measuring nitrogen oxides emissions discharged to the atmosphere; or

(2) If the owner or operator has installed a nitrogen oxides emission rate continuous emission monitoring system (CEMS) to meet the requirements of part 75 of this chapter and is continuing to meet the ongoing requirements of part 75 of this chapter, that CEMS may be used to meet the requirements of this section, except that the owner or operator shall also meet the requirements of § 60.49b. Data reported to meet the requirements of § 60.49b shall not include data substituted using the missing data procedures in subpart D of part 75 of this chapter, nor shall the data have been bias adjusted according to the procedures of part 75 of this chapter.

* * * * *

11. Section 60.49b is amended by adding paragraph (v) to read as follows:

§ 60.49b Reporting and recordkeeping requirements.

* * * * *

(v) The owner or operator of an affected facility may submit electronic quarterly reports for SO_2 and/or NO_X and/or opacity in lieu of submitting the written reports required under paragraphs (h), (i), (j), (k) or (l) of this section. The format of each quarterly electronic report shall be coordinated with the permitting authority. The electronic report(s) shall be submitted no later than 30 days after the end of the calendar quarter and shall be accompanied by a certification statement from the owner or operator, indicating whether compliance with the applicable emission standards and minimum data requirements of this subpart was achieved during the reporting period. Before submitting reports in the electronic format, the owner or operator shall coordinate with the permitting authority to obtain their agreement to submit reports in this alternative format.

[FR Doc. 98–24733 Filed 9–15–98; 8:45 am]

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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 63

[FRL—6157–1]

RIN 2060–AH74

National Emission Standards for Hazardous Air Pollutants for Source Category: Pulp and Paper Production

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule; interpretation and technical amendment.

SUMMARY: Under the authority of the Clean Air Act, the EPA has promulgated standards at 40 CFR part 63, subpart S (63 FR 18504, April 15, 1998) to reduce hazardous air pollutant (HAP) emissions from the pulp and paper production source category. This rule is known as

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 51, 60, 61, and 63

[AD–FRL–6300–4]

Recordkeeping and Reporting Burden Reduction

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final amendments.

SUMMARY: On September 11, 1996, the EPA proposed changes to reduce unnecessary reporting and recordkeeping burdens due to regulations implementing the Clean Air Act (the Act). This review was part of a Government-wide initiative as directed by the President on March 1, 1995. With today's document, the EPA is finalizing the proposed changes, with minor amendments as discussed below. On the whole, public comments that were received on the proposed changes were overwhelmingly supportive of the Agency's efforts.

DATES: *Effective Date.* April 13, 1999.

Judicial Review. Under Section 307(b)(1) of the Act, judicial review is available only by filing a petition for review in the U.S. Court of Appeals for the District of Columbia Circuit within 60 days of today's publication of this final rule. Under Section 307(b)(2) of the Act, the requirements that are the subject of today's document may not be challenged later in civil or criminal proceedings brought by the EPA to enforce these requirements.

ADDRESSES: *Docket.* Docket No. A–95–50, containing supporting information used in developing the final amendments to the standards, is available for public inspection and copying from 8:00 a.m. to 5:30 p.m., Monday through Friday, at the EPA's Air and Radiation Docket and Information Center (6102), 401 M Street, SW, Washington, D.C. 20460; telephone (202) 260–7548. Both the public comment letters and a detailed summary of the comments and the EPA's responses to them are included in the docket. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: For information concerning the standards or technical aspects, contact Mr. David W. Markwordt, Emission Standards Division (MD–13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711; telephone (919) 541–0837.

SUPPLEMENTARY INFORMATION:

An electronic version of this rule is available for download from the EPA Technology Transfer Network (TTN) at "http://www.epa.gov/ttn/oarpg/ramain.html". For assistance in downloading files, call the TTN Help line at (919) 541–5384.

I. Significant Public Comments and Responses

Fourteen letters on the proposed revisions were received. Of these, four were from State agencies and ten were from industry commenters. A detailed discussion of all the comments and the EPA's responses can be found in the comment summary and response document, which is referenced in the **ADDRESSES** section of this preamble. This summary of comments and responses serves as the basis for the revisions that have been made to the standards between proposal and promulgation. Most of the comment letters contained multiple comments.

The comments addressed the General Provisions for 40 CFR parts 60, 61, and 63; NSPS for Steam Generators (40 CFR part 60 subparts D, Da, Db, and Dc); NSPS for Municipal Waste Combustors (40 CFR 60 subpart Ea); Emission Reporting Requirements for 40 CFR part 51; NSPS for New Residential Wood Heaters (40 CFR part 60 subpart AAA); and additional burden reduction. These comments and the EPA's responses are summarized below.

A. General Provisions for 40 CFR Parts 60, 61, and 63

The EPA's proposals concerning reducing the record keeping and reporting burden in the General Provisions were generally supported. Nine commenters strongly supported the EPA's commitment to reducing record keeping and reporting burdens. Three commenters also supported the EPA's proposal to allow electronic data submission, and made detailed suggestions concerning implementation of electronic reporting. The EPA's proposal to eliminate the notification of the anticipated date of initial startup was also supported by four commenters. Five commenters supported the EPA's proposal to require only a 7-day notice prior to rescheduling a performance test. However, sources in this situation should notify their delegated State agency (or EPA Region if there is no delegated State agency) as soon as possible, when they have a need to use this provision. There were no negative comments on the EPA's proposals concerning electronic data submission, eliminating notification of anticipated initial startup date, and requiring only a 7-day prior notice for rescheduling a performance test.

This document corrects a typographical error in the proposal notice (61 FR 47852). The EPA's intent was to delete the paragraph requiring notification of the anticipated date of startup for new affected facilities. Section 63.9(b)(2)(iv) was erroneously cited. The correct citation is section 63.9(b)(4)(iv).

1. Quarterly or Semi-Annual Reporting

Three commenters supported the proposed change to semi-annual excess emissions reporting, arguing that semi-annual reporting would be sufficient to ensure compliance and would reduce regulatory costs and burden. One of the commenters contended that State and local regulations would also need to be revised to semi-annual reporting to realize the cost savings. However, one commenter supported retaining the requirement for quarterly reporting, stating that a reduction of reporting frequency would result in an inability for State and local agencies to identify and respond to violations in a timely manner, and delay the resolution of enforcement actions. The commenter requested that the EPA add language to § 60.7(c), and any other applicable sections, specifying that semi-annual reporting would not apply when more frequent reporting is specifically required by a State or local agency. Two commenters supported retaining the quarterly reporting requirement only for continuous emissions monitoring (CEMs) and continuous opacity monitors (COMs), as such a requirement would allow response to emission problems in a timely manner.

The EPA recognizes that some State and local agencies audit quarterly. States are not precluded from adopting more stringent requirements than the Federal regulations and are free to maintain quarterly reporting requirements for CEMs and COMs data. The semi-annual reporting requirements comport with those under the part 70 and part 71 title V operating permit program regulations, which require monitoring, record keeping, and reporting sufficient to demonstrate compliance with applicable requirements under the Clean Air Act (Act).

One of the commenters noted that § 63.10(e)(3) already allows semi-annual reporting, but that the requirement is too restrictive. The commenter suggested that plants triggering quarterly reporting because of excess emissions only be subject to a 6-month period of quarterly reporting. If the 6 months expire with no further exceedances, the reporting schedule would automatically revert to semiannual reporting. While the commenter is correct that § 63.10(e)(3) allows semi-annual reporting, paragraph (e)(3)(i)(C) modifies the requirement in the case where a source experiences excessive emissions. As explained in the proposal notice (61 FR 47844), the EPA's experience over the past ten years with a variety of NSPS and NESHAP rulemakings covering industries of all types suggests that semi-annual reporting provides sufficiently timely information to both ensure compliance and enable adequate enforcement of applicable requirements, while imposing less burden on the affected industry than would quarterly reporting. Therefore, the EPA will finalize its proposal to remove § 63.10(e)(3)(i)(C), which results in a reduction of the burden for those sources who would have otherwise been affected by its requirements.

2. Reduction in Retention of Sub-Hourly Data for CEMs

In today's amendments, the EPA is finalizing the proposed changes to allow owners or operators the option to reduce record keeping requirements of sub-hourly data recorded by CEMs. Six commenters provided specific comments pertaining to these amendments (IV–D–01, IV–D–02, IV–D–04, IV–D–08, IV–D–07, IV–D–10).

Two commenters (IV–D–07, IV–D–10) supported the revisions that allow for the reduced data record keeping from 15-minute to hourly interval.

Two other commenters (IV–D–02, IV–D–04) stated that the proposal would eliminate the regulatory authority's ability to determine if the hourly averages reflect the actual data readings. Additionally, one commenter (IV–D–02) requested EPA to revise the language concerning data availability to state that the 15-minute readings could be discarded except where a State or local agency requires retention of such data.

Two commenters (IV–D–01, IV–01–08) opposed the EPA's proposal on the grounds that it adds a record keeping requirement, maintaining that the current regulations do not require retention of the 15-minute data averages. One (IV–D–01) further commented that CEMs do not typically save sub-hourly measurements, and that the revision would conflict with requirements in 40 CFR part 75. These commenters (IV–D–01, IV–01–08) were also concerned that the revision would create an additional cost burden by requiring expansion of data acquisition capabilities.

The EPA has revised the proposed amendments to address compliance concerns raised by State agencies. In addition, the EPA believes that it is necessary to point out that these amendments provide an option to the owners or operator, and the requirement is not mandatory. For sources with CEMs that decide to comply with the record retention requirements as amended in today's rulemaking, the owner and operator maintains the burden of proof for hourly averages that the source claims is invalid. The owner or operator may not later assert that the hourly averages were based on invalid data, if the source did not previously identify the hour as including periods of monitor system breakdown, repair, calibration checks, and zero and span adjustments.

With respect to the amendments, the EPA no longer requires that a source achieve 95% data availability in order to discard the sub-hourly measurements. The EPA decided to eliminate the data availability requirement based on the fact that the general provisions define a priority data availability of 100%, unless allowed otherwise within individual rules. Further, a demonstration of compliance with the 95% data availability threshold would require additional record keeping, running counter to the goal of burden reduction.

The agency has restructured the final amendments to distinguish between automated and manual CEMs. This is because both systems have different ways (e.g., computerized versus manual) to reduce the data to the final form of the standard. The requirements provide record keeping reductions for both automated and manual CEMs, but differ in the record retention requirements depending on the type of CEMs. The basis for the difference is to allow an inspector to determine if the sub-hourly data is being properly reduced in both instances. In cases where the data reduction is automated, it is expected that data reduction procedures would not vary; hence, the Agency is only requiring the retention of sub-hourly measurements from the most recent three averaging periods, so as to allow a replicable check of the data reduction calculations. Where data is manually reduced, there is greater potential for variation between data reduction calculations; hence, it needs to be possible to confirm the accuracy of the periodic reports.

The agency has added language that requires the hourly averages include periods of CEMs malfunction or breakdown, for sources wishing to delete the sub-hourly data. This restriction is necessary to ensure that data which indicates potential emission violations are not both excluded from the hourly average and then destroyed due to mis-classification as a CEMs breakdown or malfunction. Since § 60.13(h) allows sources to exclude data from the hourly average which was collected during periods of monitor malfunction, § 60.13(h) has also been amended to reference the new provision at § 60.7(f) which allows for disposal of raw data in limited circumstances.

Finally a paragraph has been added to the final amendments to allow the Administrator or a delegated authority, such as the State or local agency, the ability to require an owner or operator to maintain all sub-hourly data, if the Administrator finds the data necessary to more accurately assess compliance.

As discussed above, two commenters (IV–D–01, IV–01–08) asserted that the current regulations do not require the retention of 15-minute data averages. EPA disagrees with this these commenters. In fact, § 63.10(b)(2)(vii) requires retention of all "required measurements needed to achieve compliance with a relevant standard (including, but not limited to 15-minute averages of CMS data . . .)," which is consistent with the monitoring requirements laid out in § 63.8. Similarly, § 60.7(f) requires retention of all continuous monitoring system device measurements, which builds from the requirement in § 60.13(e)(2) to measure and record data for each successive 15-minute period.

B. 40 CFR Part 60, Subparts D, Da, Db, and Dc

Several commenters supported the EPA's proposal to reduce reporting frequency for part 60 subparts D, Da, Db, and Dc boilers from quarterly to semi-annual. The EPA will implement the proposed changes with this document. In addition, the EPA has made other minor changes to related language in these subparts to clarify the semi-annual reporting requirements.

One commenter further suggested that the EPA accept the semi-annual reporting requirement for steam generators that are subject to part 75 (the acid rain program). This commenter explained that many units subject to subpart D are also subject to part 75, and would not benefit from the proposed revisions unless they were accepted for compliance with part 75 also. One commenter disagreed, preferring that both part 75 and part 60 retain the quarterly reporting requirement. This commenter stated that the quarterly data are used to determine continuous compliance, and the change would not reduce the reporting burden on sources.

One commenter suggested that the EPA could further reduce the regulatory burden for subpart Dc boilers by eliminating the reporting requirement in §§ 60.48c(f)(1) and 60.48c(e)(11) regarding fuel supplier certification, and allowing record keeping to document compliance. This commenter said that the record keeping provisions in § 60.48c(e)(11) should also be simplified to allow the affected facility to maintain records that the supplier is contractually obligated to provide fuel oil.

Revisions to part 75 are not within the scope of this rulemaking. However, the EPA will consider whether part 75 should be amended to require semi-annual, rather than quarterly, reporting in future rulemakings. States are not precluded from adopting more stringent requirements than the Federal regulations and are free to maintain quarterly reporting requirements for any CEMs or COMs data that may be required under parts 60, 61, and 63. The EPA will also consider the proposal to replace the reporting requirements in §§ 60.48c(f)(1) and 60.48c(e)(11) with record keeping requirements in future rulemakings.

C. 40 CFR Part 60, Subpart Ea

One commenter opposed changing the reporting requirements for municipal waste combustors from quarterly to semi-annual because these sources may potentially be opt-in units subject to the part 75 regulations, which require quarterly reporting. This commenter reasoned that acid rain municipal waste combustors are controversial sources that the public perceives as an environmental problem, and that the change would not reduce the reporting burden.

The Agency recognizes that State and local agencies may elect to be more stringent than the Federal regulations and require quarterly reporting for identified source categories such as municipal waste combustors. However, the EPA does not believe that any changes from the proposed rule are needed, in this case. The EPA has made minor wording changes to the final language to clarify the reporting requirements for affected sources.

D. 40 CFR Part 51, Subpart Q

Two commenters opposed the EPA's proposal to raise the emission reporting threshold from 100 to 200 tons per year (tpy). Both commenters indicated that a higher threshold would not reduce the source reporting burden, as the 100 tpy threshold information would still be required by the States to determine whether other Clean Air Act programs would apply.

The EPA did not propose the change to reduce the amount of information collected by the States. The Agency recognizes that the States gather this information to support their own planning and permitting purposes and do not gather this information in response to this rule. The proposed change focuses on reducing the amount of the information that States transfer to the EPA (and the burden that results from this transfer of information).

One commenter suggested that the EPA should revamp the entire subpart. The commenter identified four ways in which the Agency should revise the regulation: (1) Allow an additional six months for facilities to provide information to the States and for the States to then enter the data into their system for transferral to the Aerometric Information Retrieval System (AIRS); (2) Decrease the reporting of data items; (3) Update the users' manuals and forms for data submittal; and (4) Delete the requirement for HATREMS in § 51.323, as it no longer exists.

In general, the purpose of the proposed change is directed at reducing the burden that results from the States transmitting data to the EPA. The burden on industry to report this data to the States does not result from this rule. States require their industries to report such information for the States' own planning and permitting purposes. The EPA also considered the specific suggestions raised by the commenters. During recent discussions in a joint EPA/State and local work group, State and local representatives (STAPPA/ALAPCO) agreed that a 6-month schedule made sense and was feasible even if extending the time period is contrary to the need for timely emissions data. Second, the rule does not require most of the data items supported by AIRS; however, AIRS includes these data items at the request of State and local agencies to support their own program needs. Reporting additional data items is completely voluntary. Third, the EPA has acknowledged the need for updating § 51.323 as part of the burden reduction exercise and has done so in the final amendments. Finally, the Agency agrees with the need for removing any reference to HATREMS; however, the Agency views moving data reporting to the facility level as inappropriate because of the limited usefulness of such data.

E. 40 CFR Part 60, Subpart AAA

As part of the record keeping and reporting burden reduction initiative, the Agency proposed to revise part 60, subpart AAA—NSPS; New Residential Wood Heaters. The proposed revisions included editorial changes for two provisions of the rule, and deletion of the entire prohibitions section.

Written comments on the proposed changes to the wood heater NSPS were submitted by the Hearth Products Association (HPA), which had no objection to the two proposed editorial changes. However, they did object to changes to the prohibitions section of the rule. The HPA's comments regarding changes to the prohibitions section and the Agency's response to those comments are addressed in a separate **Federal Register** notice (see Docket #A-95-50 IV-E-01 and 02).

After reviewing the comments received, the Agency is proceeding with the editorial changes. These modifications to the rule will make it easier to understand as well as administer; thereby, reducing the resources needed to achieve compliance with the rule. However, the Agency has decided to revise § 60.538, Prohibitions, in a separate **Federal Register** notice (see Docket #A-95-50 IV-E-01 and 02).

F. 40 CFR Part 61, Subpart F

As part of the record keeping and reporting burden reduction initiative, the Agency solicited comment on the concept of removing the requirement for the fixed-point monitoring system and associated record keeping from the vinyl chloride standard.

Written comments explained that area monitoring requirements in the vinyl chloride NESHAP rule should be eliminated because they are duplicative of and less effective than instrumental monitoring; that computerized leak detecting systems or other similar devices would be more effective in identifying major releases; that the Hazardous Organic NESHAP (HON) rule applies to all facilities subject to the vinyl chloride NESHAP and supersedes that rule; and that area monitoring is extremely costly. The commenter requested that the EPA consider replacing the area monitoring program with the use of the Leak Detection and Repair (LDAR) program.

The EPA agrees that a continuous area monitoring program has significant costs, and that the area monitoring program is less effective in detecting leaking equipment than a leak detection and repair program using instrumental monitoring. The EPA disagrees with the comment regarding the Hazardous Organic NESHAP (HON) applying to all facilities subject to the vinyl chloride NESHAP. The HON leak detection and repair program applies to operations which produce ethylene dichloride (EDC) and vinyl chloride monomer (VCM) as primary products, but does not apply to polyvinyl chloride or copolymers production. And, the HON does not supersede the area monitoring requirements of the vinyl chloride NESHAP. The EPA regards the area monitoring role as distinctly different than that of a leak detection program, although at times the area monitoring is a helpful indicator when leaks exist. The EPA regards continuous area monitoring as the most reliable way to quickly detect major releases from process equipment including but not limited to leaking equipment. The EPA is open to innovative ways to achieve the same result in a less costly way. In recent cases, process related releases have occurred that would have been unnoticed by leak detection and repair procedures, and would have gone undetected for extended periods had it not been for an area monitoring program. These types of releases can be extremely harmful to human health and the environment, and the liability for these releases could be far more costly than the area monitoring requirements. For these reasons the EPA does not intend to make any change to the area monitoring requirements at this time.

G. Additional Burden Reductions

Suggestions for additional burden reduction included: (1) merging the part 60 reporting requirements with the emission inventory requirements to create a single coordinated set of requirements; (2) allowing the title V permitting authority to exempt area sources of hazardous air pollutants (HAP) from the startup, shutdown, and malfunction plan required under § 63.10(d)(5)(i) and (ii); (3) eliminating § 50.145(a)(2), as notifications of otherwise unrelated activities are good candidates for deletion; and (4) Eliminating all routine reports of compliance information under parts 60, 61, and 63 for sources that have title V permits.

One commenter requested that the EPA reduce the vinyl chloride NESHAP reporting requirement from quarterly to semi-annual.

One commenter explained in detail why the incidental wood furniture manufacturing requirements were onerous, and proposed three solutions to remedy the problems with the record keeping requirements of the rule: (1) eliminate the record keeping requirements for incidental wood manufacturers; (2) limit the record keeping requirement to incidental wood furniture manufacturers who make furniture for commercial sale; or (3) replace the record keeping requirements with a one-time certification that the facility does not use more than 100 gallons per month in manufacturing wood furniture. The commenter recommended the second approach, and suggested revisions to the language at § 63.800(a) to implement the change.

The EPA is committed to reducing regulatory burden. The Agency appreciates the positive response to its proposals, and will continue to seek ways to minimize record keeping and reporting requirements in future rulemakings.

II. Administrative Requirements

A. Docket

The docket for this rulemaking is A–95–50. The docket is an organized and complete file of all the information submitted to or otherwise considered by the EPA in the development of this rulemaking. The principle purposes of the docket are: (1) to allow interested parties a means to identify and locate documents so that they can effectively participate in the rulemaking process; and (2) to serve as the record in case of judicial review (except for interagency review materials) (Section 307(d)(7)(A) of the Act). The docket is available for public inspection at the EPA's Air and Radiation Docket and Information Center, the location of which is given in the **ADDRESSES** section of this document.

B. Analysis Under E.O. 12866, the Unfunded Mandates Reform Act of 1995, the Regulatory Flexibility Act, and the Small Business Regulatory Enforcement Fairness Act of 1996

Because the regulatory revisions that are the subject of today's document would reduce the regulatory burden, this action is not a "significant" regulatory action within the meaning of Executive Order 12866, and does not impose any Federal mandate on State, local and tribal governments or the private sector within the meaning of the Unfunded Mandates Reform Act of 1995. Further, the EPA has determined that it is not necessary to prepare a regulatory flexibility analysis in connection with this action under the Regulatory Flexibility Act and the Small Business Regulatory Enforcement Fairness Act of 1996. The regulatory changes proposed here are expected to reduce regulatory burdens on small businesses, and are not expected to have any adverse effect on small businesses. Therefore, the EPA certifies that this rule will not have a significant impact on a substantial number of small entities.

C. Paperwork Reduction Act

The revisions to existing standards are intended to reduce existing record keeping and reporting requirements. In the proposal notice (61 FR 47840), the EPA explained the changes, identified who would be affected by the changes, and estimated the reductions associated with each change. The EPA also requested comment on all aspects of the paperwork burden reductions, including the number of affected entities and estimate of burden reduction. Comments on the proposed rule revisions were generally favorable, and acknowledged the burden reduction that would occur due to the proposed changes. Although there were no quantitative estimates of burden reduction, public comments in particular recognized the burden reduction that would occur as a result of the changes from quarterly to semi-annual reporting and of deleting notification of the anticipated date of initial startup. There were no public comments on the EPA's numerical estimates of burden reduction in the proposal (61 FR 47841). As the result of EPA's analysis of the public comments received on technical aspects of the proposed changes, the EPA is making only minor, insignificant changes to the proposed rule in the promulgated version of the revisions. Therefore, the EPA's original estimate of the record keeping and reporting burden due to the revisions remains unchanged from proposal.

D. National Technology Transfer and Advancement Act

Under Section 12 of the National Technology Transfer and Advancement Act of 1995, the EPA must consider the use of "voluntary consensus standards," if available and applicable, when implementing policies and programs, unless it would be "inconsistent with applicable law or otherwise impractical." The intent of the National Technology Transfer and Advancement Act is to reduce the costs to the private and public sectors by requiring federal agencies to draw upon any existing, suitable technical standards used in commerce or industry.

A "voluntary consensus standard" is a technical standard developed or adopted by a legitimate standards-developing organization. The Act defines "technical standards" as "performance-based or design-specific technical specifications and related management systems practices." A legitimate standards-developing organization must produce standards by consensus and observe principles of due process, openness, and balance of interests. Examples of organizations that are regarded as legitimate standards-developing organizations include the American Society for Testing and

Materials (ASTM), International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), American Petroleum Institute (API), National Fire Protection Association (NFPA) and Society of Automotive Engineers (SAE).

Since today's action does not involve the establishment or modification of technical standards, the requirements of the National Technology Transfer and Advancement Act do not apply.

E. Executive Order 13045—Protection of Children From Environmental Health Risks and Safety Risks

Executive Order 13045, entitled Protection of Children from Environmental Health Risks and Safety Risks (62 FR 19885, April 23, 1997), applies to any rule that (1) OMB determines is "economically significant" as defined under Executive Order 12866, and (2) EPA determines the environmental health or safety risk addressed by the rule has a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety aspects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

These regulatory revisions are not subject to the Executive Order because it is not economically significant as defined in E.O. 12866, and because the Agency does not have reason to believe the environmental health or safety risks addressed by this action present a disproportionate risk to children.

F. Executive Order 13084—Consultation and Coordination with Indian Tribal Governments

Under Executive Order 13084, EPA may not issue a regulation that is not required by statute, that significantly or uniquely affects the communities of Indian tribal governments, and that imposes substantial direct compliance costs on those communities, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by the tribal governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 13084 requires EPA to provide to the Office of Management and Budget, in a separately identified section of the preamble to the rule, a description of the extent of EPA's prior consultation with representatives of affected tribal governments, a summary of the nature of their concerns, and a statement supporting the need to issue the regulation. In addition, Executive Order 13084 requires EPA to develop an effective process permitting elected officials and other representatives of Indian tribal governments "to provide meaningful and timely input in the development of regulatory policies on matters that significantly or uniquely affect their communities."

Today's rule does not significantly or uniquely affect the communities of Indian tribal governments. These rule revisions impose no enforceable duties on these entities. Rather, these rule revisions reduce burdens associated with certain regulatory requirements. Accordingly, the requirements of section 3(b) of Executive Order 13084 do not apply to this rule.

G. Executive Order 12875: Enhancing the Intergovernmental Partnership

Under Executive Order 12875, EPA may not issue a regulation that is not required by statute and that creates a mandate upon a State, local or tribal government, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by those governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 12875 requires EPA to provide to the Office of Management and Budget a description of the extent of EPA's prior consultation with representatives of affected State, local and tribal governments, the nature of their concerns, copies of any written communications from the governments, and a statement supporting the need to issue the regulation. In addition, Executive Order 12875 requires EPA to develop an effective process permitting elected officials and other representatives of State, local and tribal governments "to provide meaningful and timely input in the development of regulatory proposals containing significant unfunded mandates."

Today's rule changes do not create a mandate on State, local or tribal governments. The rule changes do not impose any enforceable duties on these entities. Rather, the rule changes reduce recordkeeping and reporting burden for certain regulatory requirements. Accordingly, the requirements of section 1(a) of Executive Order 12875 do not apply to this rule.

H. Submission to Congress and the Comptroller General

The Congressional Review Act, 5 U.S.C. 801 et seq., as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take affect, the agecy promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the **Federal Register**. This action is not a "major rule" as defined by 5 U.S.C. 804(2). This rule will be effective April 13, 1999.

Statutory Authority: The statutory authority for this action is provided by Sections 101, 112, 114, 116, and 301 of the Clean Air Act, as amended, 42 U.S.C. 7401, 7412, 7414, 7416, and 7601.

List of Subjects

40 CFR Part 51

Environmental protection, Air pollution control, Reporting and recordkeeping requirements.

40 CFR Part 60

Environmental protection, Air pollution control, Reporting and recordkeeping requirements.

40 CFR Part 61

Environmental protection, Air pollution control, Reporting and recordkeeping requirements.

40 CFR Part 63

Environmental protection, Air pollution control, Reporting and recordkeeping requirements.

Dated: February 4, 1999.

Carol M. Browner,

Administrator.

For the reasons set out in the preamble title 40, chapter I of the Code of Federal Regulations is to be amended as follows:

PART 51—[AMENDED]

1. The authority citation for part 51 continues to read as follows:

Authority: 42 U.S. C. 7401–7671q.

Subpart Q—[Amended]

2. Section 51.322 is amended by revising paragraphs (a)(1) and (a)(2) to read as follows:

§ 51.322 Sources subject to emissions reporting.

(a) * * *

(1) For particulate matter, PM_{10}, sulfur oxides, VOC and nitrogen oxides, any facility that actually emits a total of 181.4 metric tons (200 tons) per year or more of any one pollutant. For particulate matter emissions, the reporting requirement ends with the

reporting of calendar year 1987 emissions. For PM_{10} emissions, the reporting requirement begins with the reporting of calendar year 1988 emissions.

(2) For carbon monoxide, any facility that actually emits a total of 1814 metric tons (2000 tons) per year or more.

* * * * *

3. Section 51.323 is amended by removing and reserving paragraph (a)(2) and revising paragraphs (a)(1), (a)(3), and (b) to read as follows:

§ 51.323 Reportable emissions data and information.

(a) * * *

(1) Emissions of particulate matter (PM10), sulfur oxides, carbon monoxide, nitrogen oxides, VOC and lead or lead compounds measured as elemental lead as specified by the AIRS Facility Subsystem User's Guide AF2 "AFS Data Coding" (EPA-454/B-94-004) point source coding form.

(2) [Reserved].

(3) Emissions of PM 2.5 as will be specified in a future guideline.

(b) Such emissions data and information specified in paragraph (a) of this section must be submitted to the AIRS/AFS database via either online data entry or batch update system.

* * * * *

PART 60—[AMENDED]

1. The authority citation for part 60 is revised to read as follows:

Authority: 42 U.S.C. 7401-7601.

Subpart A—[Amended]

2. Section 60.7 is amended by removing and reserving paragraph (a)(2) and revising paragraphs (a) introductory text and (c) introductory text, the last sentence of paragraph (f), and adding paragraphs (f)(1), (f)(2), and (f)(3) to read as follows:

§ 60.7 Notification and recordkeeping.

* * * * *

(a) Any owner or operator subject to the provisions of this part shall furnish the Administrator written notification or, if acceptable to both the Administrator and the owner or operator of a source, electronic notification, as follows:

* * * * *

(c) Each owner or operator required to install a continuous monitoring device shall submit excess emissions and monitoring systems performance report (excess emissions are defined in applicable subparts) and-or summary report form (see paragraph (d) of this section) to the Administrator semiannually, except when: more frequent reporting is specifically required by an applicable subpart; or the Administrator, on a case-by-case basis, determines that more frequent reporting is necessary to accurately assess the compliance status of the source. All reports shall be postmarked by the 30th day following the end of each six-month period. Written reports of excess emissions shall include the following information:

* * * * *

(f) * * * The file shall be retained for at least two years following the date of such measurements, maintenance, reports, and records, except as follows;

(1) This paragraph applies to owners or operators required to install a continuous emissions monitoring system (CEMS) where the CEMS installed is automated, and where the calculated data averages do not exclude periods of CEMS breakdown or malfunction. An automated CEMS records and reduces the measured data to the form of the pollutant emission standard through the use of a computerized data acquisition system. In lieu of maintaining a file of all CEMS subhourly measurements as required under paragraph (f) of this section, the owner or operator shall retain the most recent consecutive three averaging periods of subhourly measurements and a file that contains a hard copy of the data acquisition system algorithm used to reduce the measured data into the reportable form of the standard.

(2) This paragraph applies to owners or operators required to install a CEMS where the measured data is manually reduced to obtain the reportable form of the standard, and where the calculated data averages do not exclude periods of CEMS breakdown or malfunction. In lieu of maintaining a file of all CEMS subhourly measurements as required under paragraph (f) of this section, the owner or operator shall retain all subhourly measurements for the most recent reporting period. The subhourly measurements shall be retained for 120 days from the date of the most recent summary or excess emission report submitted to the Administrator.

(3) The Administrator or delegated authority, upon notification to the source, may require the owner or operator to maintain all measurements as required by paragraph (f) of this section, if the Administrator or the delegated authority determines these records are required to more accurately assess the compliance status of the affected source.

* * * * *

3. Section 60.8 is amended by revising paragraph (d) to read as follows:

§ 60.8 Performance tests.

* * * * *

(d) The owner or operator of an affected facility shall provide the Administrator at least 30 days prior notice of any performance test, except as specified under other subparts, to afford the Administrator the opportunity to have an observer present. If after 30 days notice for an initially scheduled performance test, there is a delay (due to operational problems, etc.) in conducting the scheduled performance test, the owner or operator of an affected facility shall notify the Administrator (or delegated State or local agency) as soon as possible of any delay in the original test date, either by providing at least 7 days prior notice of the rescheduled date of the performance test, or by arranging a rescheduled date with the Administrator (or delegated State or local agency) by mutual agreement.

* * * * *

3A. Section 60.13 is amended by revising the fourth sentence in paragraph (h) to read as follows:

§ 60.13 Monitoring requirements.

* * * * *

(h) * * *Data recorded during periods of continuous system breakdown, repair, calibration checks, and zero and span adjustments shall not be included in the data averages computed under this paragraph. For owners and operators complying with the requirements in § 60.7(f) (1) or (2), data averages must include any data recorded during periods of monitor breakdown or malfunction. * * *

* * * * *

4. Section 60.19 is amended by revising paragraph (b) to read as follows:

§ 60.19 General notification and reporting requirements.

* * * * *

(b) For the purposes of this part, if an explicit postmark deadline is not specified in an applicable requirement for the submittal of a notification, application, report, or other written communication to the Administrator, the owner or operator shall postmark the submittal on or before the number of days specified in the applicable requirement. For example, if a notification must be submitted 15 days before a particular event is scheduled to take place, the notification shall be postmarked on or before 15 days preceding the event; likewise, if a notification must be submitted 15 days after a particular event takes place, the notification shall be delivered or postmarked on or before 15 days following the end of the event. The use of reliable non-Government mail carriers that provide indications of verifiable delivery of information required to be submitted to the Administrator, similar to the postmark provided by the U.S. Postal Service, or alternative means of delivery, including the use of electronic media, agreed to by the permitting authority, is acceptable.

* * * * *

Subpart D—[Amended]

5. Section 60.45 is amended by revising paragraph (g) introductory text to read as follows:

§ 60.45 Emission and fuel monitoring.

* * * * *

(g) Excess emission and monitoring system performance reports shall be submitted to the Administrator semiannually for each six-month period in the calendar year. All semiannual reports shall be postmarked by the 30th day following the end of each six-month period. Each excess emission and MSP report shall include the information required in § 60.7(c). Periods of excess emissions and monitoring systems (MS) downtime that shall be reported are defined as follows:

* * * * *

Subpart Da—[Amended]

6. Section 60.49a is amended by revising paragraph (i) to read as follows:

§ 60.49a Reporting requirements.

* * * * *

(i) The owner or operator of an affected facility shall submit the written reports required under this section and subpart A to the Administrator semiannually for each six-month period. All semiannual reports shall be postmarked by the 30th day following the end of each six-month period.

* * * * *

Subpart Db—[Amended]

7. Section 60.49b is amended by revising paragraphs (d), (e), (h) introductory text, (i), (j), (k)(2), (k)(3), (m) introductory text, (n) introductory text, (n)(1), (n)(2), (q) introductory text, (q)(2), (q)(3), (r), and (s) to read as follows:

§ 60.49b Reporting and recordkeeping requirements.

* * * * *

(d) The owner or operator of an affected facility shall record and maintain records of the amounts of each fuel combusted during each day and calculate the annual capacity factor individually for coal, distillate oil, residual oil, natural gas, wood, and municipal-type solid waste for the reporting period. The annual capacity factor is determined on a 12-month rolling average basis with a new annual capacity factor calculated at the end of each calendar month.

(e) For an affected facility that combusts residual oil and meets the criteria under §§ 60.46b(e)(4), 60.44b (j), or (k), the owner or operator shall maintain records of the nitrogen content of the residual oil combusted in the affected facility and calculate the average fuel nitrogen content for the reporting period. The nitrogen content shall be determined using ASTM Method D3431–80, Test Method for Trace Nitrogen in Liquid Petroleum Hydrocarbons (IBR-see § 60.17), or fuel suppliers. If residual oil blends are being combusted, fuel nitrogen specifications may be prorated based on the ratio of residual oils of different nitrogen content in the fuel blend.

* * * * *

(h) The owner or operator of any affected facility in any category listed in paragraphs (h) (1) or (2) of this section is required to submit excess emission reports for any excess emissions which occurred during the reporting period.

* * * * *

(i) The owner or operator of any affected facility subject to the continuous monitoring requirements for nitrogen oxides under § 60.48(b) shall submit reports containing the information recorded under paragraph (g) of this section.

(j) The owner or operator of any affected facility subject to the sulfur dioxide standards under § 60.42b shall submit reports.

(k) * * *

(2) Each 30-day average sulfur dioxide emission rate (ng/J or lb/million Btu heat input) measured during the reporting period, ending with the last 30-day period; reasons for noncompliance with the emission standards; and a description of corrective actions taken.

(3) Each 30-day average percent reduction in sulfur dioxide emissions calculated during the reporting period, ending with the last 30-day period; reasons for noncompliance with the emission standards; and a description of corrective actions taken.

* * * * *

(m) For each affected facility subject to the sulfur dioxide standards under § 60.42(b) for which the minimum amount of data required under § 60.47b(f) were not obtained during the reporting period, the following information is reported to the Administrator in addition to that required under paragraph (k) of this section:

* * * * *

(n) If a percent removal efficiency by fuel pretreatment (i.e., % R_f) is used to determine the overall percent reduction (i.e., % R_o) under § 60.45b, the owner or operator of the affected facility shall submit a signed statement with the report.

(1) Indicating what removal efficiency by fuel pretreatment (i.e., % R_f) was credited during the reporting period;

(2) Listing the quantity, heat content, and date each pre-treated fuel shipment was received during the reporting period, the name and location of the fuel pretreatment facility; and the total quantity and total heat content of all fuels received at the affected facility during the reporting period.

* * * * *

(q) The owner or operator of an affected facility described in § 60.44b(j) or § 60.44b(k) shall submit to the Administrator a report containing:

* * * * *

(2) The average fuel nitrogen content during the reporting period, if residual oil was fired; and

(3) If the affected facility meets the criteria described in § 60.44b(j), the results of any nitrogen oxides emission tests required during the reporting period, the hours of operation during the reporting period, and the hours of operation since the last nitrogen oxides emission test.

(r) The owner or operator of an affected facility who elects to demonstrate that the affected facility combusts only very low sulfur oil under § 60.42b(j)(2) shall obtain and maintain at the affected facility fuel receipts from the fuel supplier which certify that the oil meets the definition of distillate oil as defined in § 60.41b. For the purposes of this section, the oil need not meet the fuel nitrogen content specification in the definition of distillate oil. Reports shall be submitted to the Administrator certifying that only very low sulfur oil meeting this definition was combusted in the affected facility during the reporting period.

(s) The reporting period for the reports required under this subpart is each six-month period. All reports shall be submitted to the Administrator and shall be postmarked by the 30th day following the end of the reporting period.

Subpart Dc—[Amended]

8. Section 60.48c is amended by revising paragraphs (c), (d), (e) introductory text, (e)(2), (e)(3), and (e)(11); and by adding paragraph (j) to read as follows:

§ 60.48c Reporting and recordkeeping requirements.

* * * * *

(c) The owner or operator of each coal-fired, residual oil-fired, or wood-fired affected facility subject to the opacity limits under § 60.43c(c) shall submit excess emission reports for any excess emissions from the affected facility which occur during the reporting period.

(d) The owner or operator of each affected facility subject to the SO_2 emission limits, fuel oil sulfur limits, or percent reduction requirements under § 60.42c shall submit reports to the Administrator.

(e) The owner or operator of each affected facility subject to the SO_2 emission limits, fuel oil sulfur limits, or percent reduction requirements under § 60.43c shall keep records and submit reports as required under paragraph (d) of this section, including the following information, as applicable.

* * * * *

(2) Each 30-day average SO_2 emission rate (nj/J or lb/million Btu), or 30-day average sulfur content (weight percent), calculated during the reporting period, ending with the last 30-day period; reasons for any noncompliance with the emission standards; and a description of corrective actions taken.

(3) Each 30-day average percent of potential SO_2 emission rate calculated during the reporting period, ending with the last 30-day period; reasons for any noncompliance with the emission standards; and a description of the corrective actions taken.

* * * * *

(11) If fuel supplier certification is used to demonstrate compliance, records of fuel supplier certification is used to demonstrate compliance, records of fuel supplier certification as described under paragraph (f)(1), (2), or (3) of this section, as applicable. In addition to records of fuel supplier certifications, the report shall include a certified statement signed by the owner or operator of the affected facility that the records of fuel supplier certifications submitted represent all of the fuel combusted during the reporting period.

* * * * *

(j) The reporting period for the reports required under this subpart is each six-month period. All reports shall be submitted to the Administrator and shall be postmarked by the 30th day following the end of the reporting period.

Subpart Ea—[Amended]

9. Section 60.59a is amended by revising paragraphs (e), (f), and (g) to read as follows:

§ 60.59a Reporting and recordkeeping requirements.

* * * * *

(e)(1) The owner or operator of an affected facility located within a large MWC plant shall submit annual compliance reports for sulfur dioxide, nitrogen oxide (if applicable), carbon monoxide, load level, and particulate matter control device temperature to the Administrator containing the information recorded under paragraphs (b)(1), (2)(ii), (4), (5), and (6) of this section for each pollutant or parameter. The hourly average values recorded under paragraph (b)(2)(i) of this section are not required to be included in the annual reports. Combustors firing a mixture of medical waste and other MSW shall also provide the information under paragraph (b)(15) of this section, as applicable, in each annual report. The owner or operator of an affected facility must submit reports semiannually once the affected facility is subject to permitting requirements under Title V of the Act.

(2) The owner or operator shall submit a semiannual report for any pollutant or parameter that does not comply with the pollutant or parameter limits specified in this subpart. Such report shall include the information recorded under paragraph (b)(3) of this section. For each of the dates reported, include the sulfur dioxide, nitrogen oxide, carbon monoxide, load level, and particulate matter control device temperature data, as applicable, recorded under paragraphs (b)(2)(ii)(A) through (D) of this section.

(3) Reports shall be postmarked no later than the 30th day following the end of the annual or semiannual period, as applicable.

(f)(1) The owner or operator of an affected facility located within a large MWC plant shall submit annual compliance reports, as applicable, for opacity. The annual report shall list the percent of the affected facility operating time for the reporting period that the opacity CEMS was operating and collecting valid data. Once the unit is subject to permitting requirements under Title V of the Act, the owner or operator of an affected facility must submit these reports semiannually.

(2) The owner or operator shall submit a semiannual report for all periods when the 6-minute average levels exceeded the opacity limit under § 60.52a. The semiannual report shall include all information recorded under paragraph (b)(3) of this section which pertains to opacity, and a listing of the 6-minute average opacity levels recorded under paragraph (b)(2)(i)(A) of this section, which exceeded the opacity limit.

(3) Reports shall be postmarked no later than the 30th day following the end of the annual of semiannual period, as applicable.

(g)(1) The owner or operator of an affected facility located within a large MWC plant shall submit reports to the Administrator of all annual performance tests for particulate matter, dioxin/furan, and hydrogen chloride as recorded under paragraph (b)(7) of this section, as applicable, from the affected facility. For each annual dioxin/furan compliance test, the maximum demonstrated MWC unit load and maximum demonstrated particulate matter control device temperature shall be reported. Such reports shall be submitted when available and in no case later than the date of required submittal of the annual report specified under paragraphs (e) and (f) of this section, or within six months of the date the test was conducted, whichever is earlier.

(2) The owner or operator shall submit a report of test results which document any particulate matter, dioxin/furan, and hydrogen chloride levels that were above the applicable pollutant limit. The report shall include a copy of the test report documenting the emission levels and shall include the corrective action taken. Such reports shall be submitted when available and in no case later than the date required for submittal of any semiannual report required in paragraphs (e) or (f) of this section, or within six months of the date the test was conducted, whichever is earlier.

* * * * *

Subpart J—[Amended]

10. Section 60.107 is amended by revising paragraphs (a), (c) introductory text, (d), and (e) to read as follows:

§ 60.107 Reporting and recordkeeping requirements.

* * * * *

(a) Each owner or operator subject to § 60.104(b) shall notify the Administrator of the specific provisions of § 60.104(b) with which the owner or operator seeks to comply. Notification shall be submitted with the notification of initial startup required by § 60.7(a)(3). If an owner or operator elects at a later date to comply with an alternative provision of § 60.104(b), then the Administrator shall be notified by the owner or operator in the report described in paragraph (c) of this section.

* * * * *

(c) Each owner or operator subject to § 60.104(b) shall submit a report except as provided by paragraph (d) of this section. The following information shall be contained in the report:

* * * * *

(d) For any periods for which sulfur dioxide or oxides emissions data are not available, the owner or operator of the affected facility shall submit a signed statement indicating if any changes were made in operation of the emission control system during the period of data unavailability which could affect the ability of the system to meet the applicable emission limit. Operations of the control system and affected facility during periods of data unavailability are to be compared with operation of the control system and affected facility before and following the period of data unavailability.

(e) The owner or operator of an affected facility shall submit the reports required under this subpart to the Administrator semiannually for each six-month period. All semiannual reports shall be postmarked by the 30th day following the end of each six-month period.

* * * * *

11. Section 60.108 is amended by revising paragraph (e) to read as follows:

§ 60.108 Performance test and compliance provisions.

* * * * *

(e) Each owner or operator subject to § 60.104(b) who has demonstrated compliance with one of the provisions of § 60.104(b) but a later date seeks to comply with another of the provisions of § 60.104(b) shall begin conducting daily performance tests as specified under paragraph (d) of this section immediately upon electing to become subject to one of the other provisions of § 60.104(b). The owner or operator shall furnish the Administrator with a written notification of the change in the semiannual report required by § 60.107(e).

Subpart CC—[Amended]

12. Section 60.293 is amended by revising paragraphs (c)(4), (c)(5), (d)(3) introductory text and (d)(3)(iii) to read as follows:

§ 60.293 Standards for particulate matter from glass melting furnace with modified-processes.

* * * * *

(c) * * *

(4) Determine, based on the 6-minute opacity averages, the opacity value corresponding to the 99 percent upper confidence level of a normal distribution of average opacity values.

(5) For the purposes of § 60.7, report to the Administrator as excess emissions all of the 6-minute periods during which the average opacity, as measured by the continuous monitoring system installed under paragraph (c)(1) of this section, exceeds the opacity value corresponding to the 99 percent upper confidence level determined under paragraph (c)(4) of this section.

(d) * * *

(3) An owner or operator may redetermine the opacity value corresponding to the 99 percent upper confidence level as described in paragraph (c)(4) of this section if the owner or operator:

* * * * *

(iii) Uses the redetermined opacity value corresponding to the 99 percent upper confidence level for the purposes of paragraph (c)(5) of this section.

* * * * *

Subpart NN—[Amended]

13. Section 60.403 is amended by revising paragraph (f) to read as follows:

§ 60.403 Monitoring of emissions and operations.

* * * * *

(f) Any owner or operator subject to the requirements under paragraph (c) of this section shall report on a frequency specified in § 60.7(c) all measurement results that are less than 90 percent of the average levels maintained during the most recent performance test conducted under § 60.8 in which the affected facility demonstrated compliance with the standard under § 60.402.

Subpart XX—[Amended]

14. Section 60.502 is amended by revising paragraphs (e)(3) and (e)(4) to read as follows:

§ 60.502 Standards for Volatile Organic Compound (VOC) emissions from bulk gasoline terminals.

* * * * *

(e) * * *

(3)(i) The owner or operator shall cross-check each tank identification number obtained in paragraph (e)(2) of this section with the file of tank vapor tightness documentation within 2 weeks after the corresponding tank is loaded, unless either of the following conditions is maintained:

(A) If less than an average of one gasoline tank truck per month over the last 26 weeks is loaded without vapor tightness documentation then the documentation cross-check shall be performed each quarter; or

(B) If less than an average of one gasoline tank truck per month over the last 52 weeks is loaded without vapor tightness documentation then the documentation cross-check shall be performed semiannually.

(ii) If either the quarterly or semiannual cross-check provided in paragraphs (e)(3)(i) (A) through (B) of this section reveals that these conditions were not maintained, the source must return to biweekly monitoring until such time as these conditions are again met.

(4) The terminal owner or operator shall notify the owner or operator of each non-vapor-tight gasoline tank truck loaded at the affected facility within 1 week of the documentation cross-check in paragraph (e)(3) of this section.

* * * * *

Subpart AAA—[Amended]

15. Section 60.531 is amended by revising the definition for "wood heater" to read as follows:

§ 60.531 Definitions.

* * * * *

Wood heater means an enclosed, wood burning appliance capable of and intended for space heating or domestic water heating that meets all of the following criteria:

(1) An air-to-fuel ratio in the combustion chamber averaging less than 35-to-1 as determined by the test procedure prescribed in § 60.534 performed at an accredited laboratory;

(2) A usable firebox volume of less than 20 cubic feet;

(3) A minimum burn rate of less than 5 kg/hr as determined by the test procedure prescribed in § 60.534 performed at an accredited laboratory; and

(4) A maximum weight of 800 kg. In determining the weight of an appliance for these purposes, fixtures and devices that are normally sold separately, such as flue pipe, chimney, and masonry components that are not an integral part of the appliance or heat distribution ducting, shall not be included.

16. Section 60.536 is amended by revising paragraph (f)(3) to read as follows:

§ 60.536 Permanent label, temporary label, and owner's manual.

* * * * *

(f) * * *

(3) If an appliance is a coal-only heater as defined in § 60.530, the following statement shall appear on the permanent label:

U.S. Environmental Protection Agency

This heater is only for burning coal. Use of any other solid fuel except for coal ignition purposes is a violation of Federal law.

* * * * *

Subpart SSS—[Amended]

17. Section 60.714 is amended by revising paragraph (a) to read as follows:

§ 60.714 Installation of monitoring devices and recordkeeping.

* * * * *

(a) Each owner or operator of an affected coating operation that utilizes less solvent annually than the applicable cutoff provided in § 60.710(b) and that is not subject to § 60.712 (standards for coating operations) shall maintain records of actual solvent use.

* * * * *

18. Section 60.717 is amended by revising paragraphs (c) and (d) introductory text, to read as follows:

§ 60.717 Reporting and monitoring requirements.

* * * * *

(c) Each owner or operator of an affected coating operation initially utilizing less than the applicable volume of solvent specified in § 60.710(b) per calendar year shall report the first calendar year in which actual annual solvent use exceeds the applicable volume.

(d) Each owner or operator of an affected coating operation, or affected coating mix preparation equipment subject to § 60.712(c), shall submit semiannual reports to the Administrator documenting the following:

* * * * *

PART 61—[AMENDED]

1. The authority citation for part 61 continues to read as follows:

Authority: 42 U.S.C. 7401, 7412, 7414, 7416, 7601.

Subpart A—[Amended]

2. Section 61.04 is amended by revising paragraph (b) introductory text to read as follows:

§ 61.04 Address.

* * * * *

(b) Section 112(d) of the Act directs the Administrator to delegate to each State, when appropriate, the authority to implement and enforce national emission standards for hazardous air pollutants for stationary sources located in such State. If the authority to implement and enforce a standard under this part has been delegated to a State, all information required to be submitted to EPA under paragraph (a) of this section shall also be submitted to the appropriate State agency (provided, that each specific delegation may exempt sources from a certain Federal or State reporting requirement). The Administrator may permit all or some of the information to be submitted to the appropriate State agency only, instead of to EPA and the State agency. If acceptable to both the Administrator and the owner or operator of a source, notifications and reports may be submitted on electronic media. The appropriate mailing address for those States whose delegation request has been approved is as follows:

* * * * *

Subpart L—[Amended]

3. Section 61.139 is amended by removing paragraphs (i)(1)(ii), and paragraph (j)(3); re-designating paragraph (i)(1)(iv) as paragraph (i)(1)(ii); re-designating paragraph (i)(1)(v) as paragraph (i)(1)(iv); and revising newly designated paragraph (i)(1)(ii), and paragraphs (j)(2) introductory text, and (j)(2)(iv) to read as follows:

§ 61.139 Provisions for alternative means for process vessels, storage tanks, and tar-intercepting sumps.

* * * * *

(i) * * *

(1) * * *

(ii) For each carbon absorber, a plan for the method for handling captured benzene and removed carbon to comply with paragraphs (b)(1) and (2) of this section.

* * * * *

(j) * * *

(2) The following information shall be reported as part of the semiannual reports required in § 61.138(f).

* * * * *

(iv) For each vapor incinerator, the owner or operator shall specify the method of monitoring chosen under paragraph (f)(2) of this section in the first semiannual report. Any time the owner or operator changes that choice, he shall specify the change in the first semiannual report following the change.

* * * * *

Subpart M—[Amended]

4. Section 61.142 is amended by revising paragraph (b)(6) to read as follows:

§ 61.142 Standard for asbestos mills.

* * * * *

(b) * * *

(6) Submit semiannually a copy of visible emission monitoring records to the Administrator if visible emissions occurred during the report period. Semiannual reports shall be postmarked by the 30th day following the end of the six-month period.

* * * * *

5. Section 61.144 is amended by revising paragraph (b)(8) to read as follows:

§ 61.144 Standard for manufacturing.

* * * * *

(b) * * *

(8) Submit semiannually a copy of the visible emission monitoring records to the Administrator if visible emission occurred during the report period. Semiannual reports shall be postmarked by the 30th day following the end of the six-month period.

6. Section 61.147 is amended by revising paragraph (b)(8) to read as follows:

§ 61.147 Standard for fabricating.

* * * * *

(b) * * *

(8) Submit semiannually a copy of the visible emission monitoring records to the Administrator if visible emission occurred during the report period. Semiannual reports shall be postmarked by the 30th day following the end of the six-month period.

Subpart N—[Amended]

7. Section 61.163 is amended by revising paragraph (c)(3) to read as follows:

§ 61.163 Emission monitoring.

* * * * *

(c) * * *

(3) Determine, based on the 6-minute opacity averages, the opacity value corresponding to the 99 percent upper confidence level of a normal or log-normal (whichever the owner or operator determines is more representative) distribution of the average opacity values.

* * * * *

PART 63—[AMENDED]

1. The authority citation for part 63 continues to read as follows:

Authority: 42 U.S.C. 7401 *et seq.*

Subpart A—[Amended]

2. Section 63.8 is amended by adding the last sentence in paragraph (g)(5) to read as follows:

§63.8 Monitoring requirements.

* * * * *

(g) * * *

(5) * * * For owners or operators complying with the requirements of § 63.10(b)(2)(vii) (A) or (B), data averages must include any data recorded during periods of monitor breakdown or malfunction.

§ 63.9 [Amended]

3. Section 63.9 is amended by removing and reserving paragraph (b)(4)(iv).

4. Section 63.10 is amended by adding paragraphs (b)(2)(vii)(A), (b)(2)(vii)(B), and (b)(2)(vii)(C) and removing and reserving paragraph (e)(3)(i)(C) to read as follows:

§ 63.10 Recordkeeping and reporting requirements.

* * * * *

(b) * * *

(2) * * *

(vii) * * *

(A) This paragraph applies to owners or operators required to install a continuous emissions monitoring system (CEMS) where the CEMS installed is automated, and where the calculated data averages do not exclude periods of CEMS breakdown or malfunction. An automated CEMS records and reduces the measured data to the form of the pollutant emission standard through the use of a computerized data acquisition system. In lieu of maintaining a file of all CEMS subhourly measurements as required under paragraph (b)(2)(vii) of this section, the owner or operator shall retain the most recent consecutive three averaging periods of subhourly measurements and a file that contains a hard copy of the data acquisition system algorithm used to reduce the measured data into the reportable form of the standard.

(B) This paragraph applies to owners or operators required to install a CEMS where the measured data is manually reduced to obtain the reportable form of the standard, and where the calculated data averages do not exclude periods of CEMS breakdown or malfunction. In lieu of maintaining a file of all CEMS subhourly measurements as required under paragraph (b)(2)(vii) of this section, the owner or operator shall retain all subhourly measurements for the most recent reporting period. The subhourly measurements shall be retained for 120 days from the date of the most recent summary or excess emission report submitted to the Administrator.

(C) The Administrator or delegated authority, upon notification to the source, may require the owner or operator to maintain all measurements as required by paragraph (b)(2)(vii), if the administrator or the delegated authority determines these records are required to more accurately assess the compliance status of the affected source.

* * * * *

[FR Doc. 99–3252 Filed 2–11–99; 8:45 am]

BILLING CODE 6560–50–P

Small Entities

Under the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*), the Coast Guard considers whether this final rule will have a significant economic impact on a substantial number of small entities. "Small entities" include (1) small businesses, not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and (2) governmental jurisdictions with populations of less than 50,000.

Since the old State Route 292 bascule bridge across Bayou Chico, mile 0.3, at Pensacola, Florida, has been removed from service and is presently being dismantled, the rule governing the bridge is no longer needed. Therefore, the Coast Guard certifies under 5 U.S.C. 605(b) that this final rule will not have a significant economic impact on a substantial number of small entities

Collection of Information

This final rule does not provide for a collection of information under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*).

Federalism

The Coast Guard has analyzed this final rule under the principals and criteria contained in Executive Order 12612 and has determined that this rulemaking does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Environment

The Coast Guard considered the environmental impact of this final rule and concluded that under Figure 2-1, CE # 32(e) of the NEPA Implementing Procedures, COMDINST M16475.IC, this final rule is categorically excluded from further environmental documentation. A "Categorical Exclusion Determination" is available in the docket for inspection or copying where indicated under ADDRESSES.

List of Subjects in 33 CFR Part 117

Bridges.

Regulations

For the reasons set out in the preamble, the Coast Guard is amending part 117 of title 33, Code of Federal Regulations, as follows:

PART 117—DRAWBRIDGE OPERATION REGULATIONS

1. The authority citation for part 117 continues to read as follows:

Authority: 33 U.S.C. 499; 49 CFR 1.46; 33 CFR 1.05-1(g); section 117.255 also issued under the authority of Pub. L. 102-587, 105 Stat. 5039.

§ 117.265 [Removed]

2. Section 117.265 is removed.

Dated: February 12, 1999.

Paul J. Pluta,

Rear Admiral, U.S. Coast Guard Commander Eighth Coast Guard District.

[FR Doc. 99-5108 Filed 3-1-99; 8:45 am]

BILLING CODE 4910-15-M

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 60

[AD-FRL-6234-8]

RIN 2060-AH95

Amendment to National Standards of Performance for Steel Plants: Electric Arc Furnaces Constructed After October 21, 1974, and On or Before August 17, 1983, and Electric Arc Furnaces Constructed After August 17, 1983

AGENCY: Environmental Protection Agency (EPA).

ACTION: Direct final rule; amendments to rule.

SUMMARY: This action amends the national standards of performance for new stationary sources (NSPS) for electric arc furnaces (EAF) constructed after October 21, 1974, and on or before August 17, 1983 (40 CFR part 60, subpart AA), and the NSPS for EAF constructed after August 17, 1983 (40 CFR part 60, subpart AAa). Changes to both rules are being made to add alternative requirements for the monitoring of EAF capture systems in response to recommendations made by the Common Sense Initiative (CSI) subcommittee on iron and steel. The CSI was established by the Administrator to bring together affected stakeholders to find cleaner, cheaper, and smarter environmental management solutions.

In addition, the EPA is revising two definitions for consistency and making a number of editorial changes. The EPA does not believe that these editorial changes will affect the applicability or requirements of the rule.

DATES: This rule will be effective without further notice on May 3, 1999 unless the Agency receives adverse comments by April 1, 1999. Should the Agency receive such comments, it will publish a timely withdrawal in the **Federal Register** informing the public that this rule will not take effect. If a public hearing is requested, the comment period will end 30 days after the date of the public hearing, in which case EPA will publish a document in the **Federal Register** announcing the hearing information and the extended comment period.

Public Hearing. Anyone requesting a public hearing must contact the person listed below under FOR FURTHER INFORMATION CONTACT no later than March 12, 1999. If a hearing is held, it will take place on March 17, 1999, beginning at 10:00 a.m.

ADDRESSES: *Docket.* Docket No. A-79-33, containing information considered by the EPA in development of this action, is available for public inspection and copying between 8:00 a.m. and 5:30 p.m., Monday through Friday except for Federal holidays, at the following address: U.S. Environmental Protection Agency, Air and Radiation Docket and Information Center (MC-6102), 401 M Street, S.W., Washington, D.C. 20460; telephone (202) 260-7548. The docket is located at the above address in Room M-1500, Waterside Mall (ground floor). A reasonable fee may be charged for copying.

Comments. Written comments should be submitted to: Docket A-79-33, U.S. EPA, Air & Radiation Docket & Information Center, 401 M Street, S.W., Room 1500, Washington, D.C. 20460.

Hearing. Inquiries regarding a public hearing should be directed to the person listed under FOR FURTHER INFORMATION CONTACT.

FOR FURTHER INFORMATION CONTACT: Mr. Kevin Cavender, Metals Group, Emission Standards Division (MD-13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711; telephone (919) 541-2364.

SUPPLEMENTARY INFORMATION:

The EPA is publishing this rule without prior proposal because the Agency views these amendments as noncontroversial and anticipates no adverse comments. However, in the proposed rules section of this **Federal Register** publication, EPA is publishing a separate document that will serve as the proposal to amend 40 CFR part 60, subpart AA and 40 CFR subpart AAa should adverse comments be filed. This rule will be effective May 3, 1999 without further notice unless the Agency receives adverse comments by April 1, 1999.

If EPA receives such comments, the Agency will publish a timely withdrawal of the direct final rule informing the public that the rule will not take effect. All public comments received will be addressed in a subsequent final rule based on the proposed rule. The EPA will not institute a second comment period on this rule. Parties interested in commenting on this rule should do so at this time. If no such comments are received, the public is advised that this rule will be effective on May 3, 1999 and no further action will be taken on the proposed rule.

The remainder of this preamble is organized as follows:

I. Background

A. Process Description

An EAF is used to produce carbon and alloy steels (two digit SIC Code 33—Primary Metal Industries). The input material to an EAF is typically 100 percent scrap steel. Cylindrical, refractory lined EAF are equipped with carbon electrodes to be raised or lowered through the furnace roof. With electrodes retracted the furnace roof can be rotated aside to permit the charge of scrap steel by overhead crane. Alloying agents and fluxing materials usually are added through the doors on the side of the furnace. Electric current of the opposite polarity is passed between the electrodes and through the scrap, generating heat. After melting and refining periods, the slag and steel are poured from the furnace.

The production of steel in an EAF is a batch process. Cycles, or "heats", range from about 1½ to 5 hours to produce carbon steel and from 5 to 10 hours to produce alloy steel. Scrap steel is charged to begin a cycle, and alloying agents and slag materials are added for refining. Stages of each cycle normally are charging, melting, refining (which usually includes oxygen blowing), and tapping.

All of these operations generate particulate emissions. Emission control techniques involve an emission capture system and a gas cleaning system. Five emission capture systems used in the industry are direct shell (fourth hole) evacuation, side draft hood, combination hood, canopy hood, and furnace enclosures. Direct shell evacuation (DEC) consists of ductwork attached to a separate, or fourth hole, in the furnace roof which draws emissions to a gas cleaner. The direct shell evacuation system works only when the furnace is up-right and the roof is in place. The side draft hoods collect furnace off gases from around the electrode holes and the work doors after the gases leave the furnace. The combination hood incorporates elements from the side draft and direct shell evacuation systems.

B. Current NSPS Shop Opacity Requirements

The NSPS for EAF constructed after October 21, 1974, and on or before August 17, 1983 (40 CFR part 60, subpart AA) was first promulgated in the **Federal Register** on September 23, 1975 (40 FR 43850). Subpart AA establishes a shop opacity limit of less than 6 percent during melting and refining, less than 20 percent during charging, and less than 40 percent during tapping. Shop opacity is defined in the rule as the arithmetic average of 24 or more opacity observations of emissions from the shop taken in accordance with EPA Reference Method 9. However, the shop opacity emission limits are only applicable during periods when control system parameters are being established. The rule relies on control system monitoring to ensure adequate capture of emissions from the EAF.

The NSPS for EAF constructed after August 17, 1983 (40 CFR part 60, subpart AAa) was first promulgated in the **Federal Register** on October 31, 1984 (49 FR 43845). Subpart AAa establishes a shop opacity limit of less than 6 percent which is applicable at all times. Also, shop opacity is defined as the arithmetic average of 24 opacity observations of emissions from the shop taken in accordance with EPA Reference Method 9.

In both subparts, when an owner or operator is required to demonstrate compliance with the shop opacity limits, they are also required to establish the furnace pressures (if a direct shell evacuation capture system is used), and either the capture system fan motor amperes and damper positions or the capture system flow rates in each separately ducted hood. Once established, the owner or operator is required to maintain these parameters (within certain tolerances) at the levels established during the shop opacity compliance demonstration. Monitoring of these parameters provides indirect evidence of continued capture effectiveness.

C. CSI Iron and Steel Subcommittee Recommendation

The CSI Council is established under a charter approved pursuant to the Federal Advisory Committee Act (FACA). The purpose of the CSI is to advise, consult with, and make recommendations to the Administrator with respect to matters pertaining to improvements in the nation's pollution control and prevention programs. The CSI brings affected stakeholders together to find cleaner, cheaper, and smarter environmental management solutions. The CSI members consist of independent experts selected from among the national and local environmental interest groups, industry, State and local governments, and other stakeholders such as labor organizations, environmental justice organizations, and the Federal government. Six subcommittees were created including the iron and steel subcommittee.

Today's action implements recommendations received from the CSI Iron and Steel Subcommittee (Docket ID No. IV–B–4). Concerns were raised to the CSI regarding the use of a pressure monitoring system in the free space above an EAF when it is equipped with a direct shell evacuation system. The free space above an EAF is subject to severe conditions of high temperature and dust. Several owners and operators have had problems with frequent plugging of the pressure monitoring sensor. Due to the location of the sensor, maintenance and repair can be both difficult and dangerous. Industry representatives sought a more practical means of monitoring.

Following discussions and negotiations between the various subcommittee members, the subcommittee recommended daily visible emissions observations as an alternative to pressure monitoring. As discussed above, pressure monitoring provides an indirect indication of continued capture effectiveness. Daily visible emissions observations will provide direct evidence of continued capture effectiveness.

The second concern regards the monitoring of fan amperage. Both subparts give the owners and operators the option of either monitoring flow rates in each separately ducted hood, or monitoring fan amperage in conjunction with damper positions. Fan amperage is used as an indicator of total flow rate.

A concern was raised that fan amperage was not necessarily directly correlated to exhaust flow rates, and could be affected by other factors such as ambient temperature. Therefore, it was recommended that owners and operators be given the option to monitor total flow rate directly, rather than using fan amperage as an indicator.

The CSI subcommittee also requested that the EPA clarify the conditions under which alternative monitoring requirements can be approved under 40 CFR 60.13(i). Section 60.13(i) states, "After receipt and consideration of written application, the Administrator may approve alternatives to any monitoring procedures or requirements of this part including, but not limited to the following: . . ." A list of conditions under which alternative monitoring requirements can be approved is also provided. The EPA wishes to clarify that the list of conditions given is not all inclusive. The Administrator may approve alternatives due to other conditions based on his or her judgement that an alternative monitoring procedure is warranted.

II. Summary of Amendments

The EPA is amending the two EAF rules to implement the CSI recommendations. The changes will not remove any of the rules' requirements, but will add alternative monitoring options that will provide owners and operators more flexibility in complying with the rules while not reducing environmental benefit. The EPA is also taking this opportunity to make several minor editorial corrections to the rules and to clarify two definitions. These amendments will (1) add daily shop opacity observations as an alternative to monitoring furnace static pressure for furnaces with DEC systems, (2) allow facilities to locate the furnace static pressure monitor in the EAF or DEC duct prior to the introduction of ambient air, (3) add control system volumetric flow rate monitoring as an alternative to monitoring control system fan amperage, and (4) make editorial changes and clarify definitions.

A. Daily Visible Emissions Observations

The EPA is amending both subpart AA and subpart AAa to allow daily visual emissions observations as an alternative to furnace static pressure monitoring. Under this alternative, an owner or operator will be required to perform shop opacity observations once per day during a meltdown and refining period. Records shall be maintained of all observations, and observations of shop opacity at or above six percent during a meltdown and refining period shall be reported to the Administrator semi-annually as an excess emission.

B. Location of Static Pressure Monitor

The EPA is amending subpart AA to allow owners or operators to locate the furnace static pressure monitor in the DEC duct prior to the introduction of ambient air. This change is consistent with the requirements in subpart AAa, and will provide greater flexibility in locating the pressure sensors where plugging may not be as serious of a problem.

C. Volumetric Flow Rate Monitoring

The EPA is amending both subpart AA and subpart AAa to allow monitoring of exhaust flow rate at the inlet of the air pollution control device as an alternative to monitoring fan amperage. Under this alternative, the owner or operator is required to install, calibrate, and maintain a monitoring device that continuously records the volumetric flow rate at the air pollution control device inlet. A shop opacity compliance demonstration will be performed to establish volumetric flow rate and damper positions. Operations at volumetric flow rates below the value established during the compliance demonstration shall be reported to the Administrator semi-annually.

D. Corrections to Definitions and Editorial Changes

The EPA is making the following corrections and editorial changes that were identified during the development of this amendment:

(1) The date in the title to subpart AAa is being corrected to August 17, 1983. This change will not affect the applicability determinations for any facilities since the date was correctly identified in the applicability section, § 60.270a.

(2) The definition of tapping period is being revised in subpart AA and added to subpart AAa to account for bottom tapping furnaces, which do not tilt.

(3) The definition of meltdown and refining period in subpart AA is being revised to exclude periods where power to the EAF is off. This change is being made to ensure that power to the EAF is on during shop opacity observations. This definition is also being added to subpart AAa for the purpose of consistency between the two rules.

(4) The reference to a 15-minute integrated average for the furnace static pressure is being removed from subpart AAa, § 60.274a(g). Unlike subpart AA, subpart AAa does not require continuous recording of pressure, and does not contain any requirements for establishing a 15-minute integrated average.

III. Administrative Requirements

A. Docket

The docket is an organized and complete file of all the information considered by the EPA in the development of this rulemaking. The docket is a dynamic file, since material is added throughout the rulemaking development. The docket system is intended to allow members of the public and affected industries to readily identify and locate documents so that they can effectively participate in the rulemaking process. Along with the background information documents (BIDs) and preambles to the proposed and promulgated standards, the contents of the docket, excluding interagency review materials, will serve as the official record in case of judicial review (section 307(d)(7)(A) of the Act).

B. Executive Order 12866

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether a regulatory action is "significant" and therefore subject to OMB review and the requirements of the Executive Order. The Executive Order defines "significant regulatory action" as one that is likely to result in a rule that may:

(1) Have a annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients thereof; or

(4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

It has been determined that these amendments to the final EAF rules are not a "significant regulatory action" under the terms of the Executive Order and are therefore not subject to OMB review.

C. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Public Law 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with "Federal mandates" that may result in expenditures to State, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year. Before promulgating an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective or least burdensome alternative if the Administrator publishes with the final rule an explanation why that alternative was not adopted. Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

The EPA has determined that this rule does not contain a Federal mandate that may result in expenditures of $100 million or more for State, local, and tribal governments, in the aggregate, or the private sector in any one year. This action only provides affected EAF owners and operators with alternative monitoring options. Thus, today's rule is not subject to the requirements of sections 202 and 205 of the UMRA.

D. Executive Order 12875

Under Executive Order 12875, EPA may not issue a regulation that is not required by statute and that creates a mandate upon a State, local or tribal government, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by those governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 12875 requires EPA to provide to the Office of Management and Budget a description of the extent of EPA's prior consultation with representatives of affected State, local and tribal governments, the nature of their concerns, copies of any written communications from the governments, and a statement supporting the need to issue the regulation. In addition, Executive Order 12875 requires EPA to develop an effective process permitting elected officials and other representatives of State, local and tribal governments "to provide meaningful and timely input in the development of regulatory proposals containing significant unfunded mandates." Today's amendments do not create a mandate on State, local or tribal governments. The amendments do not impose any enforceable duties on these entities. Accordingly, the requirements of section 1(a) of Executive Order 12875 do not apply to these amendments.

E. Executive Order 13084

Under Executive Order 13084, EPA may not issue a regulation that is not required by statute, that significantly or uniquely affects the communities of Indian tribal governments, and that imposes substantial direct compliance costs on those communities, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by the tribal governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 13084 requires EPA to provide to the Office of Management and Budget, in a separately identified section of the preamble to the rule, a description of the extent of EPA's prior consultation with representatives of affected tribal governments, a summary of the nature of their concerns, and a statement supporting the need to issue the regulation. In addition, Executive Order 13084 requires EPA to develop an effective process permitting elected officials and other representatives of Indian tribal governments "to provide meaningful and timely input in the development of regulatory policies on matters that significantly or uniquely affect their communities." Today's amendments do not significantly or uniquely affect the communities of Indian tribal governments. This action only provides affected EAF owners and operators with alternative monitoring options. Accordingly, the requirements of section 3(b) of Executive Order 13084 do not apply to this action.

F. Paperwork Reduction Act

The Office of Management and Budget (OMB) approved the information collection requirements contained in the two final EAF rules under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. and assigned the OMB control number 2060–0038.

The information collection requirements in these amendments will be submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. An information Collection Request (ICR) document has been prepared by EPA (ICR No. 1060.09) and copies may be obtained from Sandy Farmer by mail at OP Regulatory Information Division; U.S. Environmental Protection Agency (2137); 401 M St., S.W.; Washington, DC 20460, by email at farmer.sandy@epa.gov, or by calling (202) 260–2740. A copy may also be downloaded off the Internet at http://www.epa.gov/icr. The information requirements in these amendments are not effective until OMB approves them.

The new information requirements are based on recordkeeping, and reporting requirements in the NSPS general provisions (40 CFR part 60, subpart A), which are mandatory for all owners or operators of sources subject to new source performance standards. These recordkeeping and reporting requirements are specifically authorized by section 114 of the Act (42 U.S.C. 7414). All information submitted to the EPA pursuant to the recordkeeping and reporting requirements for which a claim of confidentiality is made is safeguarded according to Agency procedures set forth in 40 CFR part 2, subpart B.

The annual increase to monitoring, recordkeeping, and reporting burden for this amendment is estimated at 11,375 labor hours at a total cost of $398,238.75 nationwide, and the annual average increase in burden is 175 labor hours and $6,126.75 per source. This estimate includes daily shop opacity observations and associated semi-annual excess emissions reports and recordkeeping. There will be no increase in annualized capital/startup costs as a result of the new alternative monitoring requirements.

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An Agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR part 9 and 48 CFR Chapter 15.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, OP Regulatory Information Division; U.S. Environmental Protection Agency (2137); 401 M St., S.W.; Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th St., N.W., Washington, DC 20503, marked "Attention: Desk Officer for EPA." Comments are requested within April 1, 1999. Include the ICR number in any correspondence.

G. Regulatory Flexibility

EPA has determined that it is not necessary to prepare a regulatory flexibility analysis in connection with this final rule. This rule only provides alternative compliance options designed to provide facilities with increased flexibility. As such, the EPA has determined that this rule will not have a significant economic impact on a substantial number of small entities.

H. Submission to Congress and the General Accounting Office

The Congressional Review Act, 5 U.S.C. 801 *et seq.*, as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. The EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the **Federal Register**. A major rule cannot take effect until 60 days after it is published in the **Federal Register**. This action is not a "major rule" as defined by 5 U.S.C. 804(2). This action will be effective May 3, 1999 unless the Agency receives adverse comments by April 1, 1999.

I. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA), Public Law 104-113, section 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., material specifications, test methods, sampling and analytical procedures, business practices) that are developed or adopted by voluntary consensus standards bodies. The NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards. This action does not involve technical standards other than those already specified in the original EAF rules.

J. Protection of Children from Environmental Health Risks and Safety Risk Under Executive Order 13045

Executive Order 13045: "Protection of Children from Environmental Health Risks and Safety Risks" (62 FR 19885, April 23, 1997) applies to any rule that (1): Is determined to be "economically significant" as defined under E.O. 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

EPA interprets E.O. 13045 as applying only to those regulatory actions that are based on health or safety risks, such that the analysis required under section 5-501 of the Order has the potential to influence the regulation. This action is not subject to E.O. 13045 because it does not establish an environmental standard intended to mitigate health or safety risks.

K. Judicial Review

Under section 307(b)(1) of the Act, judicial review of a NSPS is available only by filing a petition for review in the U.S. Court of Appeals for the District of Columbia Circuit within 60 days of today's publication of this final rule. Under section 307(b)(2) of the Act, the requirements that are the subject of today's action may not be challenged later in civil or criminal proceedings brought by the EPA to enforce these requirements.

List of Subjects in 40 CFR Part 60

Environmental protection, Air pollution control, Electric arc furnace, Monitoring requirements, Reporting and recordkeeping requirements.

Dated: February 17, 1999.

Carol M. Browner,

Administrator.

For the reasons set out in the preamble title 40, chapter I, of the Code of Federal Regulations is amended as follows:

PART 60—[AMENDED]

1. The authority for part 60 continues to read as follows:

Authority: 42 U.S.C. 7401, 7411, 7413, 7414, 7416, 7429, 7601 and 7602.

2. Section 60.271 is amended by revising paragraphs (h) and (j) to read as follows:

§ 60.271 Definitions.

* * * * *

(h) *Tapping period* means the time period commencing at the moment an EAF begins to pour molten steel and ending either three minutes after steel ceases to flow from an EAF, or six minutes after steel begins to flow, whichever is longer.

* * * * *

(j) *Meltdown and refining period* means the time period commencing at the termination of the initial charging period and ending at the initiation of the tapping period, excluding any intermediate charging periods and times when power to the EAF is off.

* * * * *

3. Section 60.272 is amended by revising paragraph (a)(3)(iii) to read as follows:

§ 60.272 Standard for particulate matter.

* * * * *

(a) * * *

(3) * * *

(iii) The shop opacity standards under paragraph (a)(3) of this section shall apply only during periods when the monitoring parameter limits specified in § 60.274(b) are being established according to § 60.274(c) and (g), unless the owner or operator elects to perform daily shop opacity observations in lieu of furnace static pressure monitoring as provided for under § 60.273(d).

* * * * *

4. Section 60.273 is amended by revising paragraph (b) and adding paragraph (d) to read as follows:

§ 60.273 Emission monitoring.

* * * * *

(b) For the purpose of reports under § 60.7(c), all six-minute periods during which the average opacity is three percent or greater shall indicate a period of excess emission, and shall be reported to the Administrator semi-annually.

* * * * *

(d) A furnace static pressure monitoring device is not required on any EAF equipped with a DEC system if observations of shop opacity are performed by a certified visible emission observer as follows: Shop opacity observations shall be conducted at least once per day when the furnace is operating in the meltdown and refining period. Shop opacity shall be determined as the arithmetic average of 24 or more consecutive 15-second opacity observations of emissions from the shop taken in accordance with Method 9. Shop opacity shall be recorded for any point(s) where visible emissions are observed in proximity to an affected EAF. Where it is possible to determine that a number of visible emission sites relate to only one incident of visible emissions, only one observation of shop opacity will be required. In this case, the shop opacity observations must be made for the site of highest opacity that directly relates to the cause (or location) of visible emissions observed during a single incident.

5. Section 60.274 is amended by revising paragraphs (b), (c), (f) and (g) to read as follows:

§ 60.274 Monitoring of operations.

* * * * *

(b) Except as provided under paragraph (d) of this section, the owner or operator subject to the provisions of this subpart shall check and record on a once-per-shift basis furnace static pressure (if a DEC system is in use, and a furnace static pressure gauge is installed according to paragraph (f) of this section) and either: check and record the control system fan motor amperes and damper positions on a once-per-shift basis; install, calibrate, and maintain a monitoring device that continuously records the volumetric flow rate through each separately ducted hood; or install, calibrate, and maintain a monitoring device that continuously records the volumetric flow rate at the control device inlet and check and record damper positions on a once-per-shift basis. The monitoring device(s) may be installed in any appropriate location in the exhaust duct such that reproducible flow rate monitoring will result. The flow rate monitoring device(s) shall have an accuracy of ±10 percent over its normal operating range and shall be calibrated according to the manufacturer's instructions. The Administrator may require the owner or operator to demonstrate the accuracy of the monitoring device(s) relative to Methods 1 and 2 of appendix A of this part.

(c) When the owner or operator of an EAF is required to demonstrate compliance with the standards under § 60.272(a)(3) and at any other time the Administrator may require that (under section 114 of the Act, as amended) either: the control system fan motor amperes and all damper positions; the volumetric flow rate through each separately ducted hood; or the volumetric flow rate at the control device inlet and all damper positions shall be determined during all periods in which a hood is operated for the purpose of capturing emissions from the EAF subject to paragraph (b)(1) or (b)(2) of this section. The owner or operator may petition the Administrator for reestablishment of these parameters whenever the owner or operator can demonstrate to the Administrator's satisfaction that the EAF operating conditions upon which the parameters were previously established are no longer applicable. The values of these parameters as determined during the most recent demonstration of compliance shall be maintained at the appropriate level for each applicable period. Operation at other than baseline values may be subject to the requirements of § 60.276(a).

* * * * *

(f) Except as provided for under § 60.273(d), where emissions during any phase of the heat time are controlled by use of a direct shell evacuation system, the owner or operator shall install, calibrate, and maintain a monitoring device that continuously records the pressure in the free space inside the EAF. The pressure shall be recorded as 15-minute integrated averages. The monitoring device may be installed in any appropriate location in the EAF or DEC duct prior to the introduction of ambient air such that reproducible results will be obtained. The pressure monitoring device shall have an accuracy of ±5 mm of water gauge over its normal operating range and shall be calibrated according to the manufacturer's instructions.

(g) Except as provided for under § 60.273(d), when the owner or operator of an EAF is required to demonstrate compliance with the standard under § 60.272(a)(3) and at any other time the Administrator may require (under section 114 of the Act, as amended), the pressure in the free space inside the furnace shall be determined during the meltdown and refining period(s) using the monitoring device under paragraph (f) of this section. The owner or operator may petition the Administrator for reestablishment of the 15-minute integrated average pressure whenever the owner or operator can demonstrate to the Administrator's satisfaction that the EAF operating conditions upon which the pressures were previously established are no longer applicable. The pressure determined during the most recent demonstration of compliance shall be maintained at all times the EAF is operating in a meltdown and refining period. Operation at higher pressures may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility.

* * * * *

6. Section 60.276(d) is added to read as follows:

§ 60.276 Recordkeeping and reporting requirements.

* * * * *

(d) The owner or operator shall maintain records of all shop opacity observations made in accordance with § 60.273(d). All shop opacity observations in excess of the emission limit specified in § 60.272(a)(3) of this subpart shall indicate a period of excess emission, and shall be reported to the Administrator semi-annually, according to § 60.7(c).

7. The Title to subpart AAa is revised to read as follows:

Subpart AAa—Standards of Performance for Steel Plants: Electric Arc Furnaces and Argon-Oxygen Decarburization Vessels Constructed After August 17, 1983

8. Section 60.271a is amended by adding the following definition in alphabetical order:

§ 60.271a Definitions.

* * * * *

Meltdown and refining period means the time period commencing at the termination of the initial charging period and ending at the initiation of the tapping period, excluding any intermediate charging periods and times when power to the EAF is off.

* * * * *

Tapping period means the time period commencing at the moment an EAF begins to pour molten steel and ending either three minutes after steel ceases to flow from an EAF, or six minutes after steel begins to flow, whichever is longer.

* * * * *

9. Section 60.273a(d) is added to read as follows:

§ 60.273a Emission monitoring.

* * * * *

(d) A furnace static pressure monitoring device is not required on any EAF equipped with a DEC system if observations of shop opacity are performed by a certified visible emission observer as follows: Shop opacity observations shall be conducted at least once per day when the furnace is operating in the meltdown and refining period. Shop opacity shall be determined as the arithmetic average of 24 consecutive 15-second opacity observations of emissions from the shop taken in accordance with Method 9. Shop opacity shall be recorded for any point(s) where visible emissions are observed. Where it is possible to determine that a number of visible emission sites relate to only one incident of visible emissions, only one observation of shop opacity will be required. In this case, the shop opacity observations must be made for the site of highest opacity that directly relates to the cause (or location) of visible emissions observed during a single incident.

10. Section 60.274a is amended by revising paragraphs (b), (c), (f), and (g) to read as follows:

§ 60.274a Monitoring of operations.

* * * * *

(b) Except as provided under paragraph (d) of this section, the owner or operator subject to the provisions of this subpart shall check and record on a once-per-shift basis the furnace static pressure (if DEC system is in use, and a furnace static pressure gauge is installed according to paragraph (f) of this section) and either: check and record the control system fan motor amperes and damper position on a once-per-shift basis; install, calibrate, and maintain a monitoring device that continuously records the volumetric flow rate through each separately ducted hood; or install, calibrate, and maintain a monitoring device that continuously records the volumetric flow rate at the control device inlet and check and record damper positions on a once-per-shift basis. The monitoring device(s) may be installed in any appropriate location in the exhaust duct such that reproducible flow rate monitoring will result. The flow rate monitoring device(s) shall have an accuracy of ±10 percent over its normal operating range and shall be calibrated according to the manufacturer's instructions. The Administrator may require the owner or operator to demonstrate the accuracy of the monitoring device(s) relative to Methods 1 and 2 of appendix A of this part.

(c) When the owner or operator of an affected facility is required to demonstrate compliance with the standards under § 60.272a(a)(3) and at any other time the Administrator may require that (under section 114 of the Act, as amended) either: the control system fan motor amperes and all damper positions; the volumetric flow rate through each separately ducted hood; or the volumetric flow rate at the control device inlet and all damper positions shall be determined during all periods in which a hood is operated for the purpose of capturing emissions from the affected facility subject to paragraph (b)(1) or (b)(2) of this section. The owner or operator may petition the Administrator for reestablishment of these parameters whenever the owner or operator can demonstrate to the Administrator's satisfaction that the affected facility operating conditions upon which the parameters were previously established are no longer applicable. The values of these parameters as determined during the most recent demonstration of compliance shall be maintained at the appropriate level for each applicable period. Operation at other than baseline values may be subject to the requirements of § 60.276a(c).

* * * * *

(f) Except as provided for under § 60.273a(d), if emissions during any phase of the heat time are controlled by the use of a DEC system, the owner or operator shall install, calibrate, and maintain a monitoring device that allows the pressure in the free space inside the EAF to be monitored. The monitoring device may be installed in any appropriate location in the EAF or DEC duct prior to the introduction of ambient air such that reproducible results will be obtained. The pressure monitoring device shall have an accuracy of ±5 mm of water gauge over its normal operating range and shall be calibrated according to the manufacturer's instructions.

(g) Except as provided for under § 60.273a(d), when the owner or operator of an EAF controlled by a DEC is required to demonstrate compliance with the standard under § 60.272a(a)(3), and at any other time the Administrator may require (under section 114 of the Clean Air Act, as amended), the pressure in the free space inside the furnace shall be determined during the meltdown and refining period(s) using the monitoring device required under paragraph (f) of this section. The owner or operator may petition the Administrator for reestablishment of the pressure whenever the owner or operator can demonstrate to the Administrator's satisfaction that the EAF operating conditions upon which the pressures were previously established are no longer applicable. The pressure determined during the most recent demonstration of compliance shall be maintained at all times when the EAF is operating in a meltdown and refining period. Operation at higher pressures may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility.

* * * * *

11. Section 60.276a(g) is added to read as follows:

§ 60.276a Recordkeeping and reporting requirements.

* * * * *

(g) The owner or operator shall maintain records of all shop opacity observations made in accordance with § 60.273a(d). All shop opacity observations in excess of the emission limit specified in § 60.272a(a)(3) of this subpart shall indicate a period of excess emission, and shall be reported to the administrator semi-annually, according to § 60.7(c).

[FR Doc. 99-4576 Filed 3-1-99; 8:45 am]
BILLING CODE 6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 271

[FRL-6236-2]

Final Authorization of State Hazardous Waste Management Program Revision; Michigan

AGENCY: Environmental Protection Agency (EPA).

ACTION: Immediate final rule; correction and stay of effective date.

SUMMARY: The EPA is announcing a stay of the immediate final rule published in the **Federal Register** of October 29, 1998 (63 FR 57912), authorizing revisions to Michigan's hazardous waste management program under the Resource Conservation and Recovery Act (RCRA) and the Hazardous and Solid Waste Amendments of 1984 (HSWA). The effect of the stay is to allow for an extended public comment period. In addition, EPA is making a minor correction to the immediate final rule. If EPA receives no adverse written comments, the corrected immediate final rule will take effect as provided

federal register

Tuesday
March 9, 1999

Part II

Environmental Protection Agency

40 CFR Parts 60 and 63

Polymer and Resin Production Facilities (Groups I and IV) and Volatile Organic Compound (VOC) From the Polymer Manufacturing Industry; Final Rule and Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 60 and 63

[AD-FRL-6301-6]

RIN 2060-AH-47

National Emission Standards for Hazardous Air Pollutants Emissions: Group I Polymers and Resins and Group IV Polymers and Resins and Standards of Performance for Volatile Organic Compound (VOC) Emissions from the Polymer Manufacturing Industry

AGENCY: Environmental Protection Agency (EPA).

ACTION: Direct final rule.

SUMMARY: On September 5, 1996, the EPA issued the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Group I Polymers and Resins (61 FR 46906); on September 12, 1996, the EPA issued the Group IV Polymers and Resins NESHAP (61 FR 48208); and on December 11, 1990, the EPA issued the Standards of Performance for Volatile Organic Compound (VOC) Emissions from the Polymer Manufacturing Industry (55 FR 51035). This action revises the promulgated rules by adding provisions, correcting errors, and making clarifications in all of the above-mentioned rulemakings, as described in the remainder of this document.

DATES: The direct final rule is effective May 10, 1999 without further notice unless the Agency receives relevant adverse comments by April 8, 1999. (However, see information on the public hearing below.) Should the Agency receive such comments, it will publish a timely withdrawal informing the public that this rule will not take effect.

Public Hearing. If anyone contacts the EPA requesting to speak at a public hearing by March 19, 1999, a public hearing will be held in Research Triangle Park, North Carolina, beginning at 10 a.m. on March 23, 1999. Persons interested in attending the hearing should call Ms. Marguerite Thweatt at (919) 541-5673 to verify that a hearing will be held. If a hearing is requested, written comments must be received by April 23, 1999.

ADDRESSES: Written comments should be submitted (in duplicate, if possible) to: Air and Radiation Docket and Information Center (6102), Attention Docket Number A-92-44 (Group I Polymers and Resins) and/or Docket Number A-92-45 (Group IV Polymers and Resins), Room M-1500, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460. The EPA requests that a separate copy of each public comment be sent to the contact person listed below (see **FOR FURTHER INFORMATION CONTACT**). Comments may also be submitted electronically by following the instructions provided in **SUPPLEMENTARY INFORMATION.**

Docket. Docket numbers A-92-44 and A-92-45, containing information relevant to this Direct Final Rule, are available for public inspection between 8 a.m. and 5:30 p.m., Monday through Friday (except for Federal holidays) at the following address: U.S. Environmental Protection Agency, Air and Radiation Docket and Information Center (MC-6102), 401 M Street, SW, Washington, DC 20460. The docket is located at the above address in Room M-1500, Waterside Mall (ground floor). Alternatively, a docket index, as well as individual items contained within the docket, may be obtained by calling (202) 260-7548 or (202) 260-7549. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: Mr. Robert E. Rosensteel, Organic Chemicals Group, Emission Standards Division (MD-13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541-5608.

SUPPLEMENTARY INFORMATION:

Regulated Entities

Entities potentially regulated by this direct final rule include:

Category	Examples of regulated entities
Industry	Butyl Rubber, Halobutyl Rubber, Epichlorohydrin Elastomer, Ethylene Propylene Rubber, Hypalon™, Neoprene, Nitrile Butadiene Rubber, Nitrile Butadiene Latex, Polybutadiene Rubber, Styrene-Butadiene Rubber or Latex, Acrylonitrile Butadiene Styrene Resin, Styrene Acrylonitrile Resin, Methyl Methacrylate Acrylonitrile Butadiene Styrene Resin, Methyl Methacrylate Butadiene Styrene Resin, Poly(ethylene terephthalate) Resin, Polystyrene Resin, Nitrile Resin, Polypropylene and polyethylene producers

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be affected by this action. To determine whether your facility is regulated by this direct final rule, you should carefully examine the applicability criteria in §§ 63.480 and 63.1310 of the promulgated rules. If you have any questions regarding the applicability of this direct final rule to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

Electronic Access and Filing Addresses

This document, the promulgated texts, and other background information are available in Docket Numbers A-92-44 and A-92-45 or by request from the EPA's Air and Radiation Docket and Information Center (see **ADDRESSES**). These documents can also be accessed through the EPA web site at: http://www.epa.gov/ttn/oarpg. For further information and general questions regarding the Technology Transfer Network (TTN), call Mr. Hersch Rorex (919) 541-5637 or Mr. Phil Dickerson (919) 541-4814.

Electronic comments and data may be submitted by sending electronic mail (e-mail) to: a-and-r-docket@epamail.epa.gov. Submit comments as an ASCII file, avoiding the use of special characters and any form of encryption. Comments and data will also be accepted on diskette in Word Perfect 5.1 or 6.1 or ACSII file format. Identify all comments and data in electronic form by the docket numbers A-92-44 and/or A-92-45. No Confidential Business Information (CBI) should be submitted through electronic mail. Electronic comments may be filed online at many Federal Depository Libraries. For additional information concerning comments, see the parallel proposal action found in the Proposed Rules section of this **Federal Register**.

Outline

The information presented in this preamble is organized as follows:

I. Background

On September 5, 1996 (61 FR 46906), and September 12, 1996 (61 FR 48208), the EPA published the Group I Polymers and Resins NESHAP and the Group IV Polymers and Resins NESHAP, respectively. These regulations were promulgated as subparts U and JJJ in 40 CFR part 63. On November 25, 1996 the EPA published an Advance Notice of Proposed Rulemaking (ANPR) (61 FR 59849) informing the public of the intent to propose amendments to the recently promulgated Group I Polymers and Resins NESHAP and Group IV Polymers and Resins NESHAP.

Although it is anticipated that the amendments to the Group I and Group IV Polymers and Resins NESHAP will be published simultaneously with this Direct Final Rule, it is not likely that those amendments will be finalized prior to Spring 1999. For that reason, the EPA is publishing this direct final rule, which, as long as no relevant adverse comments are received by April 8, 1999, will become effective immediately (without further rulemaking action) on May 10, 1999. If adverse comments are received on one or more of the distinct amendments, paragraphs, or sections in this rulemaking, the EPA will publish a timely withdrawal in the **Federal Register** withdrawing the specific provisions that are the subject of adverse comment. Any provision in today's rulemaking that does not receive adverse comment will become effective on the date set out above, notwithstanding any adverse comment on any other distinct provision in today's rulemaking. The EPA is publishing this rule as a direct final rule because the EPA views this as a noncontroversial amendment and anticipates no adverse comments. However, should adverse comments be received on a distinct provision in this rulemaking, the EPA will publish a timely withdrawal in the **Federal Register** indicating which provisions will become effective and which provisions are being withdrawn. If part or all of this Direct Final Rule is withdrawn, all public comments received will be addressed in a subsequent final rule based on today's proposal. The nature of the changes contained in today's direct final rule are such that it will be of great benefit to industry and the States for these changes to become effective sooner rather than later, as will be described in more detail below.

II. Summary of and Rationale for Revisions

A. Correction to Equation in § 60.564

The first correction that this direct final rule makes is to an equation in § 60.564 of the Standards for Performance for Volatile Organic Compound (VOC) Emissions from the Polymer Manufacturing Industry (subpart DDD). The equation in § 60.564(h) is being corrected so that the emission rate determined by the equation is actually in kg total organic compound (TOC) per Mg product. During work on the other changes contained in this direct final rule, the EPA became aware that the promulgated version of the equation in § 60.564(h) misplaced the conversion factor between kilograms and megagrams, resulting in an erroneous production rate of polymer. The corrected equation results in the correct units for the emission rate of TOC (i.e., kg TOC/Mg product).

B. Modification of Compressors

The remainder of the changes contained in this Direct Final Rule are either in the Group I Polymers and Resins NESHAP, in the Group IV Polymers and Resins NESHAP, or both. The NESHAP for Group I Polymers and Resins and for Group IV Polymers and Resins omitted a provision that is contained in the Hazardous Organics NESHAP (HON), 40 CFR part 63, subpart H, on which these provisions are based. This provision, as added at §§ 63.481(d)(1)(iv) and 63.1311(d)(1)(iv), specifies another criterion to be considered in determining the compliance data for compressors.

C. Compliance Extension for Compressors

This direct final rule includes new language in § 63.1311(d)(4), as § 63.1311(d)(4)(ii), which corrects an error in the promulgated paragraph. At promulgation, this paragraph identified two situations in which a compliance extension could be requested. These situations are if the compressor must be replaced or the distance piece must be recast. A third situation (which was included in subpart U, as § 63.481(d)(4)(iii)) should have been included, which is if a design modification is required to connect the compressor to a closed-vent or recovery system. As part of adding this third situation, the paragraph was reorganized to improve the clarity.

D. Changes to the 20 ppmv Organic HAP Outlet Concentration Option for Group 1 Continuous Process Vents

Several changes have been made related to the 20 ppmv organic HAP outlet concentration compliance option for Group 1 continuous process vents subject to §§ 63.485 or 63.1315, which reference to the HON process vent requirements in §§ 63.113 through 63.118. The outlet concentration limit of 20 ppmv represents the performance limit of the control technology (see 61 FR 43698, August 26, 1996, pg. 43704 for more details). When determining compliance with the 20 ppmv outlet concentration standard under §§ 63.485 or 63.1315, the promulgated rule required that the outlet concentration be corrected to 3 percent oxygen. The changes made in this direct final rule only require a correction to 3 percent oxygen if supplemental combustion air is used to combust the emissions. A definition of supplemental combustion air has also been added. Finally, similar language has been added as part of adding a 20 ppmv outlet concentration compliance option to the aggregate batch vent stream provisions. The addition of a 20 ppmv organic HAP outlet concentration compliance option for aggregate batch vent streams is discussed later in this preamble.

The Polymers and Resins I and IV rules refer directly to the HON for control of continuous process vents subject to §§ 63.485 or 63.1315. Both rules (Polymers and Resins I and IV) refer to, and are based on, the HON process vent requirements for aggregate batch vent streams. Under the HON, the correction to 3 percent oxygen is required for purposes of demonstrating compliance with the 20 ppmv outlet concentration standard. The purpose of correcting an outlet concentration to 3 percent oxygen is to prevent owners or operators from diluting streams to meet the 20 ppmv outlet concentration standard; dilution as a means of complying with a part 63 standard is prohibited by the General Provisions (see § 63.4(b)). The value of 3 percent originates from good engineering practices. Synthetic Organic Chemical Manufacturing (SOCMI) facilities subject to the HON do not typically have high oxygen, low VOC/HAP concentration streams; streams from SOCMI unit operations are typically low oxygen, high VOC/HAP concentration streams that require supplemental combustion air for purposes of combusting the emissions. For such oxygen deficient vent streams, adding the proper amount of supplemental combustion air would result in the outlet stream containing approximately 3 percent oxygen. The HON continuous process vent provisions are written assuming that continuous process vents will require supplemental combustion air when they are combusted, and therefore requires a 3 percent oxygen correction for all continuous process vents to prevent dilution.

The concept of requiring the correction to 3 percent oxygen only when supplemental combustion air is used, as is done in this direct final rule has a precedent in the Polymer Manufacturing New Source Performance Standards (NSPS). During development of the Polymer Manufacturing NSPS, the issue of requiring a high oxygen, low VOC concentration stream to correct the outlet concentration to 3 percent oxygen was raised. Commenters made the point that an oxygen correction may be appropriate for oxygen deficient streams where supplemental combustion air has been added in order to ensure combustion of the emissions, but such a correction is not appropriate for high oxygen, low VOC concentration streams. Review of this concern revealed that requiring an oxygen correction for processes with inherently high oxygen concentration streams would amount to taking away the compliance option of reaching the 20 ppmv outlet concentration. Because the combination of low VOC/HAP concentration and technology limitations of control devices sometimes make it impossible to achieve a 98 percent emission reduction, the 20 ppmv outlet concentration may be necessary for some streams. For the group of streams that cannot demonstrate a 98 percent emission reduction, failure to address this issue would make it impossible for owners or operators to demonstrate compliance. As a result of these considerations, the final rule for the Polymer Manufacturing NSPS was changed to require a correction to 3 percent oxygen only if supplemental combustion air was used to combust the emissions.

The EPA has determined that a similar amendment is appropriate for the Polymers and Resins I and IV rules. Accordingly, the EPA has conducted a technical analysis to provide additional support for this decision. The technical analysis is documented in a memorandum to the project docket. The analysis found that an oxygen correction had not been applied to the data used to develop the 20 ppmv outlet concentration standard. Therefore, the 20 ppmv value is appropriate as an outlet concentration standard for uncorrected outlet concentrations (i.e., streams that do not require supplemental combustion air). This amendment does not alter the use of the 20 ppmv value compliance option where supplemental combustion air is used, provided, as with the promulgated rule, a 3 percent oxygen correction is made. Because the proper addition of supplemental combustion air should result in an oxygen outlet concentration of approximately 3 percent, requiring a correction to 3 percent oxygen should not change the outlet concentration of VOC/HAP significantly, and will ensure that the 20 ppmv outlet concentration standard will not be met through dilution.

In conclusion, the Polymers and Resins I and IV rules regulate industries (i.e., elastomer producers and thermoplastic producers, respectively) that may contain high oxygen, low VOC/HAP concentration process vent streams (e.g., streams that do not require supplemental combustion air such as vent streams from dryers), as well as low oxygen concentration streams. Therefore, for the same reason that a change was made to the Polymer Manufacturing NSPS and based on the support provided by the technical analysis described above, a provision to require an outlet concentration oxygen correction only when supplemental combustion air is used has been added to the continuous process vent provisions (i.e., §§ 63.485 and 63.1315) for the Polymers and Resins I and IV rules. Similar changes have been made to the aggregate batch vent stream provisions, as part of adding a 20 ppmv outlet concentration compliance option to those provisions.

Definitions of "supplemental combustion air" and "combustion device burner". The EPA has added a definition of supplemental combustion air that reads as follows:

Supplemental combustion air means the air that is added to a vent stream after the vent stream leaves the unit operation. Air that is part of the vent stream as a result of the nature of the unit operation is not considered supplemental combustion air. Air required to operate combustion device burner(s) is not considered supplemental combustion air.

In adding this definition, the EPA is distinguishing supplemental combustion air from dilution air and from air required to operate the combustion device burner(s). The second sentence of the definition clarifies that a vent stream can contain air that is *not* considered to be "supplemental combustion air," as long as the air is part of the vent stream prior to the vent stream leaving the unit operation. This clarification ensures that processes operating at ambient or near ambient oxygen levels are not considered to be using supplemental combustion air. An example of this kind of process is a dryer, where very high flow rates of ambient air are heated and blown over/through/around polymer that is being dried and very low levels of HAP are picked up as part of the drying process. The third sentence of the definition clarifies that air used to operate combustion device burner(s) is not considered supplemental combustion air. Failure to include this clarification could allow the interpretation that every combustion device uses supplemental combustion air. To further clarify the meaning of this third sentence, the EPA has added a definition of combustion device burner that reads as follows:

Combustion device burner means a device designed to mix and ignite fuel and air to provide a flame to heat and oxidize waste organic vapors in a combustion device.

The EPA is not amending the reference in these rules to the General Provisions prohibition against dilution to prevent compliance through dilution. Section 63.4(b), Circumvention, discusses the prohibition against dilution, and specifically prohibits "the use of diluents to achieve compliance with a relevant standard based on the concentration of a pollutant in the effluent discharged to the atmosphere."

E. Addition of New PET Compliance Options

Section 63.1316(b), which specifies control requirements for certain continuous process vents at poly(ethylene terephthlate) (PET) affected sources, has been amended to add compliance options based on the use of combustion devices; combustion controls allowed in other sections of this rule assure highly efficient reduction of emissions. The changes to § 63.1316(b) contained in this direct final rule will provide the same option for owners or operators of continuous dimethyl terephthalate (DMT) PET processes and continuous terephthalic acid (TPA) PET processes.

The need for these changes became apparent when a request was received from a company (Docket A-92-45, item VI-A-12) that wanted to comply with the continuous process vent requirements of § 63.1316(b) using combustion controls. In one situation, the company is controlling continuous process vents from a continuous DMT PET process with a boiler that acheives a 99.99 percent emission reduction, based on emission tests conducted by the EPA. In this case, emissions are reduced to a much greater extent than the promulgated rule requires, and wastewater streams from the process are also eliminated. In the second case, the company is controlling continuous process vents from a continuous TPA PET process with a catalytic incinerator that achieves 98 percent emission reduction. Wastewater discharges from the process are eliminated in the second case, as well. Analysis shows that emissions are reduced to a greater extent with the control systems described above than would be achieved through compliance with the separate, promulgated process vent and wastewater provisions (Docket A-92-45, Item VI-B-22).

Therefore, the EPA believes that the same combustion control options (including, but not limited to, thermal incinerators, catalytic incinerators, boilers, or process heaters) that are allowed elsewhere in this rule (for example in § 63.1316(c) for polystyrene affected sources) should be provided in § 63.1316(b), since these combustion devices are highly efficient techniques for reducing organic HAP emissions. Also, the application of these combustion techniques allows innovative control strategies, including pollution prevention measures such as those described above, which might otherwise be discouraged under the promulgated rule.

F. Clarification of the Term "Primary Condenser"

In both the Group I and the Group IV Polymers and Resins NESHAP, this Direct Final Rule is amending language in order to clarify what these rules mean by the term "primary condenser." This change is being made in §§ 63.488(a)(2) and 63.1323(a)(2). There was some confusion over the language contained in those paragraphs at promulgation (partially due to an inconsistency between the promulgated preambles and the promulgated rules), and with the new language the EPA hopes to eliminate any such confusion. As §§ 63.488(a)(2) and 63.1323(a)(2) should make clear, a primary condenser can be a condenser operating as a reflux condenser on either a reactor or distillation column, or can be a condenser operating on a stripper or distillation operation to recover monomer, reaction products, by-products, or solvent.

G. References to Test Methods for the Polymers and Resins I Rule

This direct final rule is also adding references to the Test Methods for the Polymers and Resins I Rule, which were finalized on March 17, 1997 (62 FR 12546), and are contained in Appendix A of part 63. The newly added references to those Test Methods are contained in §§ 63.495(b)(3) and (e) and 63.505(e)(1)(ii).

H. Cross-Reference and Grammatical Corrections in Emissions Averaging Provisions

This direct final rule is making cross-reference and grammatical corrections (e.g., changing "can" to "may," where appropriate) throughout §§ 63.503 and 63.1332. No substantive changes have been made to either of those two sections.

I. Removal of Reference to Obsolete HON Table

In §§ 63.506(e)(4)(ii)(H)(*1*) and 63.1335(e)(4)(ii)(L)(*1*), a reference to Table 14b of subpart G has been removed, because that table was removed in the promulgated amendments to the HON.

J. Clarification to Group 1 Storage Vessel Requirements in Subpart JJJ

A new paragraph is being introduced with this direct final rule (§ 63.1314(b)(3)), in order to clarify that, for all storage vessels that are not described in § 63.1314(b)(1) or (2), the owner or operator must control emissions to the level specified in § 63.119.

K. Process Vent Provisions for Affected Sources Producing Acrylonitrile Styrene Acrylate Resin/Alpha Methyl Styrene Acrylonitrile Resin (ASA/AMSAN)

This direct final rule includes a new paragraph at § 63.1315(e), which states the special control level for process vents at affected sources that produce acrylonitrile styrene acrylate resin (ASA) or alpha methyl styrene acrylonitrile resin (AMSAN). In addition, a reference to the new provisions in § 63.1315(e) has been added in § 63.1321, as § 63.1321(d).

L. Exemptions from Wastewater Provisions in Subpart JJJ

This direct final rule adds two paragraphs to § 63.1330, both of which act as exemptions from certain wastewater provisions in that section. The new paragraphs are § 63.1330(d) and (e), and pertain to affected sources producing ASA/AMSAN and affected sources producing polystyrene using a continuous or batch process.

M. Amendments to Tables 3 and 5 of Subpart JJJ

This direct final rule makes corrections and clarifications to both Tables 3 and 5. In the amended Table 5, the entry for Group 1 storage vessels associated with the production of styrene acrylonitrile resin (SAN) was clarified and footnote "d" was added. Because there are different control levels for different sets of storage vessels, the promulgated table appeared to present overlapping capacity and vapor pressure criteria, which was not the EPA's intent.

III. Impacts

The changes contained in this direct final rule are corrections and clarifications of the EPA's intent at the promulgation of subparts U and JJJ, and will not affect the estimated emissions reduction or the control cost for these rules. These clarifications and corrections should make it easier for owners and operators of affected sources, and for local and State authorities, to understand and implement the requirements found in subparts U and JJJ.

IV. Administrative Requirements

A. Docket

The docket is an organized and complete file of all the information considered by the EPA in the development of this rulemaking. The docket is a dynamic file, because material is added throughout the rulemaking development. The docketing system is intended to allow members of the public and industries involved to readily identify and locate documents so that they can effectively participate in the rulemaking process. Along with the proposed and promulgated standards and their preambles, the contents of the docket will serve as the record in the case of judicial review. (See section 307(d)(7)(A) of the Act.)

B. Executive Order 12866

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the EPA must submit to the Office of Management and Budget (OMB) for review significant regulatory actions. The Executive Order defines "significant regulatory action" as one that OMB determines is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or Tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

It has been determined that this Direct Final Rule does not qualify as a "significant regulatory action" under the terms of Executive Order 12866 and, therefore, is not subject to review by the Office of Management and Budget.

C. Executive Order 12875: Enhancing Intergovernmental Partnerships

Under Executive Order 12875, the EPA may not issue a regulation that is not required by statute and that creates a mandate upon a State, local, or tribal government, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by those governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 12875 requires EPA to provide to the Office of Management and Budget a description of the extent of EPA's prior consultation with representatives of affected State, local, and tribal governments, the nature of their concerns, copies of any written communications from the governments, and a statement supporting the need to issue the regulation. In addition, Executive Order 12875 requires EPA to develop an effective process permitting elected officials and other representatives of State, local, and tribal governments "to provide meaningful and timely input in the development of regulatory proposals containing significant unfunded mandates."

Today's direct final rule does not create a mandate on State, local, or tribal governments. This direct final rule does not impose any enforceable duties on these entities. Accordingly, the requirements of section 1(a) of Executive Order 12875 do not apply to this direct final rule.

D. Executive Order 13084: Consultation and Coordination With Indian Tribal Governments

Under Executive Order 13084, the EPA may not issue a regulation that is not required by statute, that significantly or uniquely affects the communities of Indian tribal governments, and that imposes substantial direct compliance costs on those communities, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by the tribal governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 13084 requires EPA to provide to the Office of Management and Budget, in a separately identified section of the preamble to the rule, a description of the extent of EPA's prior consultation with representatives of affected tribal governments, a summary of the nature of their concerns, and a statement supporting the need to issue the regulation. In addition, Executive Order 13084 requires the EPA to develop an effective process permitting elected and other representatives of Indian tribal governments "to provide meaningful and timely input in the development of regulatory policies on matters that significantly or uniquely affect their communities."

This direct final rule does not impose any duties or compliance costs on Indian tribal governments. Further, the direct final rule provided herein does not significantly alter the control standards imposed by subpart U or subpart JJJ for any source, including any that may affect communities of the Indian tribal governments. Hence, today's direct final rule does not significantly or uniquely affect the communities of Indian tribal governments. Accordingly, the requirements of section 3(b) of Executive Order 13084 do not apply to this direct final rule.

E. Unfunded Mandates Reform Act

Section 202 of the Unfunded Mandates Reform Act of 1995 (UMRA), requires that the Agency prepare a budgetary impact statement before promulgating a rule that includes a Federal mandate that may result in expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of more than $100 million in any one year. Section 203 requires the Agency to establish a plan for obtaining input from and informing, educating, and advising any small governments that may be significantly or uniquely affected by the rule.

The EPA has determined that this direct final rule does not include a Federal mandate that may result in estimated costs of, in the aggregate, $100 million or more to either State, local, or tribal governments in the aggregate, or to the private sector, and that this direct final rule does not significantly or uniquely impact small governments, because it contains no requirements that apply to such governments or impose obligations upon them. The EPA has not prepared a budgetary impact statement or specifically addressed the selection of the least costly, most cost-effective, or least burdensome alternative. In addition, because small governments will not be significantly or uniquely affected by this rule, the Agency is not required to develop a plan with regard to small governments. Therefore, the requirements of the Unfunded Mandates Act do not apply to this direct final rule.

F. Regulatory Flexibility

The Regulatory Flexibility Act (RFA) generally requires an agency to conduct a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small business, small not-for-profit enterprises, and small governmental jurisdictions. This direct final rule would not have a significant impact on a substantial number of small entities, because it clarifies and makes corrections to the promulgated versions of the Group I and IV Polymers and Resins NESHAP, but imposes no additional regulatory requirements on owners or operators of affected sources.

G. Paperwork Reduction Act

For both the Group I and Group IV Polymers and Resins NESHAP, the information collection requirements (ICRs) were submitted to the OMB under the *Paperwork Reduction Act*. At promulgation, OMB had already approved the ICRs for the Group IV Polymers and Resins NESHAP and assigned those standards the OMB control number 2060–0351. Subsequently, the OMB approved the ICRs for the Group I Polymers and Resins NESHAP, and on July 15, 1997 (62 FR 37720) the OMB control number

2060–0356 was assigned to the Group I Polymers and Resins NESHAP. An Agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for the EPA's regulations are listed in 40 CFR part 9 and 48 CFR Chapter 15. The EPA has amended 40 CFR part 9, § 9.1, to indicate the ICRs contained in the Group I and IV Polymers and Resins NESHAP.

The amendments to the NESHAP contained in this direct final rule should have no impact on the information collection burden estimates made previously. Therefore, the ICRs have not been revised.

H. Applicability of Executive Order 13045

Executive Order 13045: "Protection of Children from Environmental Health Risks and Safety Risks" (62 FR 19885, April 23, 1997) applies to any rule that (1) is determined to be "economically significant" as defined under Executive Order 12866, and (2) concerns an environmental health or safety risk that the EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

The EPA interprets Executive Order 13045 as applying only to those regulatory actions that are based on health or safety risks, such that the analysis required under section 5–501 of the Order has the potential to influence the regulation. This direct final rule is not subject to Executive Order 13045 because it does not establish an environmental standard intended to mitigate health or safety risks.

I. Submission to Congress and the Comptroller General

The Congressional Review Act, 5 U.S.C. 801 *et seq.*, added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. The EPA will submit a report containing this direct final rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of this direct final rule in the **Federal Register**. A major rule cannot take effect until 60 days after it is published in the **Federal Register**. This direct final rule is not a "major rule" as defined by 5 U.S.C. § 804(2).

J. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA) directs all Federal agencies to use voluntary consensus standards instead of government-unique standards in their regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., material specifications, test methods, sampling and analytical procedures, business practices, etc.) that are developed or adopted by one or more voluntary consensus standards bodies. Examples of organizations generally regarded as voluntary consensus standards bodies include the American Society for Testing and Materials (ASTM), the National Fire Protection Association (NFPA), and the Society of Automotive Engineers (SAE). The NTTAA requires Federal agencies like EPA to provide Congress, through OMB, with explanations when an agency decides not to use available and applicable voluntary consensus standards.

This action does not involve the proposal of any new technical standards. The EPA welcomes comments on this aspect of the Direct Final Rule and, specifically, invites the public to identify potentially-applicable voluntary consensus standards and to explain why such standards should be used in this regulation.

As part of a larger effort, the EPA is undertaking a project to cross-reference existing voluntary consensus standards on testing, sampling, and analysis with current and future EPA test methods. When completed, this project will assist the EPA in identifying potentially-applicable voluntary consensus standards which can then be evaluated for equivalency and applicability in determining compliance with future regulations.

List of Subjects

40 CFR Part 60

Environmental protection, Air pollution control, Volatile organic compounds.

40 CFR Part 63

Environmental protection, Air pollution control, Hazardous substances.

Dated: February 10, 1999.

Carol M. Browner,

Administrator.

For the reasons set out in the preamble, title 40, chapter I of the Code of Federal Regulations is amended as follows.

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

1. The authority citation for part 60 continues to read as follows:

Authority: 42 U.S.C. 7401, 7411, 7413, 7414, 7416, 7429, 7601, and 7602.

Subpart DDD—Standards of Performance for Volatile Organic Compound (VOC) Emissions From the Polymer Manufacturing Industry

* * * * *

2. Amend § 60.564 by revising paragraph (h) introductory text to read as follows:

§ 60.564 Test Methods and procedures.

* * * * *

(h) The owner or operator shall determine compliance with the mass emission per mass product standards in §§ 60.560(d) and (e) and in §§ 60.562–1(b)(1)(i), (c)(1)(i)(A), (c)(1)(ii)(A), (c)(2)(i), and (c)(2)(ii)(A).

The emission rate of TOC shall be computed using the following equation:

$$ER_{TOC} = \frac{E_{TOC}}{P_p * Mg/1000kg}$$

Where:

ER_{TOC} = Emission rate of total organic compounds (minus methane and ethane), kg TOC/Mg product.

E_{TOC} = Emission rate of total organic compounds (minus methane and ethane) in the sample, kg/hr.

P_p = The rate of polymer produced, kg/hr.

Mg/1000 kg = Mg of polymer produced per kg of polymer produced.

* * * * *

PART 63—NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FOR SOURCE CATEGORIES

3. The authority citation for part 63 continues to read as follows:

Authority: 42 U.S.C. 7401 *et seq.*

Subpart U—National Emission Standards for Hazardous Air Pollutant Emissions: Group I Polymers and Resins

4. Amend § 63.481 by revising paragraphs (d)(1)(ii), and (d)(1)(iii); and by adding paragraph (d)(1)(iv), to read as follows:

§ 63.481 Compliance schedule and relationship to existing applicable rules.

* * * * *

(d) * * *

(1) * * *

(ii) A barrier fluid system will be installed;

(iii) A new barrier fluid will be utilized which requires changes to the existing barrier fluid system; or

(iv) The compressor will be modified to permit connecting the compressor to a fuel gas system or closed vent system, or be modified so that emissions from the compressor can be routed to a process.

* * * * *

5. Amend § 63.482 by adding, in alphabetical order, definitions for "combustion device burner" and "supplemental combustion air," to paragraph (b), to read as follows:

§ 63.482 Definitions.

* * * * *

(b) * * *

Combustion device burner means a device designed to mix and ignite fuel and air to provide a flame to heat and oxidize waste organic vapors in a combustion device.

* * * * *

Supplemental combustion air means the air that is added to a vent stream after the vent stream leaves the unit operation. Air that is part of the vent stream as a result of the nature of the unit operation is not considered supplemental combustion air. Air required to operate combustion device burner(s) is not considered supplemental combustion air.

* * * * *

6. Amend § 63.485 by revising paragraph (a); by adding and reserving paragraphs (t) and (u); and by adding paragraph (v), to read as follows:

§ 63.485 Continuous front-end process vent provisions.

(a) For each continuous front-end process vent located at an affected source, the owner or operator shall comply with the requirements of §§ 63.113 through 63.118, except as provided for in paragraphs (b) through (v) of this section. The owner or operator of continuous front-end process vents that are combined with one or more batch front-end process vents shall comply with paragraph (o) or (p) of this section.

* * * * *

(v) When a combustion device is used to comply with the 20 parts per million by volume outlet concentration standard specified in § 63.113(a)(2), the correction to 3 percent oxygen is only required when supplemental combustion air is used to combust the emissions, for the purposes of this subpart. In addition, the correction to 3 percent oxygen specified in § 63.116(c)(3) and (c)(3)(iii) is only required when supplemental combustion air is used to combust the emissions, for the purposes of this subpart. Finally, when a combustion device is used to comply with the 20 parts per million by volume outlet concentration standard specified in § 63.113(a)(2), an owner or operator shall record and report the outlet concentration required in § 63.117(a)(4)(ii) and (a)(4)(iv) corrected to 3 percent oxygen when supplemental combustion air is used to combust the emissions, for the purposes of this subpart. When supplemental combustion air is not used to combust the emissions, an owner or operator may record and report the outlet concentration required in § 63.117(a)(4)(ii) and (a)(4)(iv) on an uncorrected basis or corrected to 3 percent oxygen, for the purposes of this subpart.

7. Amend § 63.487 by revising paragraph (b)(2), to read as follows:

§ 63.487 Batch front-end process vents—reference control technology.

* * * * *

(b) * * *

(2) For each aggregate batch vent stream, reduce organic HAP emissions by 90 weight percent or to a concentration of 20 parts per million by volume, whichever is less stringent, on a continuous basis using a control device. For purposes of complying with the 20 parts per million by volume outlet concentration standard, the outlet concentration shall be calculated on a dry basis. When a combustion device is used for purposes of complying with the 20 parts per million by volume outlet concentration standard, the concentration shall be corrected to 3 percent oxygen if supplemental combustion air is used to combust the emissions. If supplemental combustion air is not used, a correction to 3 percent oxygen is not required.

* * * * *

8. Amend § 63.488 by revising paragraph (a)(2), to read as follows:

§ 63.488 Methods and procedures for batch front-end process vent group determination.

(a) * * *

(2) The annual uncontrolled organic HAP or TOC emissions and annual average batch vent flow rate shall be determined at the exit from the batch unit operation. For the purposes of these determinations, the primary condenser operating as a reflux condenser on a reactor or distillation column, the primary condenser recovering monomer, reaction products, by-products, or solvent from a stripper operated in batch mode, and the primary condenser recovering monomer, reaction products, by-products, or solvent from a distillation operation operated in batch mode shall be considered part of the batch unit operation. All other devices that recover or oxidize organic HAP or TOC vapors shall be considered control devices as defined in § 63.482.

* * * * *

9. Amend § 63.490 by revising paragraph (e) introductory text and by adding paragraph (e)(3), to read as follows:

§ 63.490 Batch front-end process vents—performance test methods and procedures to determine compliance.

* * * * *

(e) *Aggregate batch vent stream testing for compliance with § 63.487(b)(2).* Except as specified in paragraphs (e)(1) through (e)(3) of this section, owners or operators of aggregate batch vent streams complying with § 63.487(b)(2) shall conduct a performance test using the performance testing procedures for continuous front-end process vents in § 63.116(c).

* * * * *

(3) When a combustion device is used to comply with the 20 parts per million by volume outlet concentration standard specified in § 63.487(b)(2), the correction to 3 percent oxygen specified in the performance testing procedures of § 63.116(c)(3) and (c)(3)(iii) is only required when supplemental combustion air is used to combust the emissions, for the purposes of this subpart.

* * * * *

10. Amend § 63.491 by revising paragraph (b)(4) introductory text and adding paragraph (b)(5), to read as follows:

§ 63.491 Batch front-end process vents—recordkeeping requirements.

* * * * *

(b) * * *

(4) The following information when using a control device to meet the

percent reduction requirement specified in § 63.487 (a)(2) or (b)(2):

* * * * *

(5) When complying with the 20 parts per million by volume outlet concentration standard specified in § 63.487(b)(2), records of the outlet concentration of organic HAP or TOC on a dry basis. If supplemental combustion air is used to combust the emissions, the outlet concentration shall be corrected to 3 percent oxygen. If supplemental combustion air is not used, a correction to 3 percent oxygen is not required.

* * * * *

11. Amend § 63.495 by revising paragraph (b)(3) and adding paragraph (e) to read as follows:

§ 63.495 Back-end process provisions—procedures to determine compliance using stripping technology.

* * * * *

(b) * * *

(3) The residual organic HAP content in each sample is to be determined using the Methods specified in paragraph (e) of this section.

* * * * *

(e) The residual organic HAP content in each sample is to be determined using the methods specified in paragraphs (e)(1) through (e)(5) of this section, as applicable.

(1) For styrene butadiene rubber produced by the emulsion process, either Method 312a, 312b, or 312c of 40 CFR part 63, appendix A, shall be used.

(2) For styrene butadiene rubber produced by the solution process, either Method 313a or 313b of 40 CFR part 63, appendix A, shall be used.

(3) For polybutadiene rubber produced by the solution process, either Method 313a or 313b of 40 CFR part 63, appendix A, shall be used.

(4) For ethylene-propylene rubber produced by the solution process, either Method 310a, 310b, or 310c of 40 CFR part 63, appendix A, shall be used.

(5) Alternatively, any other method that has been validated according to the applicable procedures in Method 301 of 40 CFR part 63, appendix A, may be used.

* * * * *

12. Amend § 63.503 by revising paragraphs (a) introductory text, (a)(2), (a)(3), (c) introductory text, (c)(2), (c)(5)(i), (c)(5)(ii), (d)(5), (e)(3)(ii), (e)(5), (g)(1), (g)(2)(ii)(A), (g)(2)(iii)(B)(1), (g)(2)(iii)(B)(*2*), (g)(3), (g)(5), (g)(7)(ii)(A), (h)(1) introductory text, (h)(3), (h)(5), (h)(6)(ii) introductory text (the Equation remains unchanged), (h)(7)(ii) introductory text, (i) introductory text, (i)(1) introductory text, (i)(1)(iii), (i)(2), (i)(3), (i)(5) introductory text, (i)(5)(i), (j)(2) introductory text, (j)(2)(ii)(B), (j)(2)(ii)(D), (j)(2)(ii)(E), (j)(2)(iv), (j)(2)(v), (k) introductory text, (k)(4) introductory text, (m)(1)(i), (m)(1)(ii), (m)(1)(iii), (m)(2)(i), (m)(2)(ii), (m)(3)(i), (m)(3)(ii), (m)(3)(iii), (m)(4)(ii), (m)(5)(i), (m)(5)(ii), (m)(5)(iii), and (m)(5)(iv), to read as follows:

§ 63.503 Emissions averaging provisions.

(a) This section applies to owners or operators of existing affected sources who seek to comply with § 63.483(b) by using emissions averaging rather than following the provisions of §§ 63.484, 63.485, 63.486, 63.494, and 63.501.

* * * * *

(2) Compliance with the provisions of this section may be based on either organic HAP or TOC.

(3) For the purposes of the provisions in this section, whenever Method 18, 40 CFR part 60, appendix A, is specified within the paragraphs of this section or is specified by reference through provisions outside this section, Method 18 or Method 25A, 40 CFR part 60, appendix A, may be used. The use of Method 25A, 40 CFR part 60, appendix A, shall conform with the requirements in paragraphs (a)(3)(i) and (a)(3)(ii) of this section.

(i) The organic HAP used as the calibration gas for Method 25A, 40 CFR part 60, appendix A, shall be the single organic HAP representing the largest percent by volume of the emissions.

(ii) The use of Method 25A, 40 CFR part 60, appendix A, is acceptable if the response from the high-level calibration gas is at least 20 times the standard deviation of the response from the zero calibration gas when the instrument is zeroed on the most sensitive scale.

* * * * *

(c) Paragraphs (c)(1) through (c)(4) of this section describe the emission points that may be used to generate emissions averaging credits if control was applied after November 15, 1990 and if sufficient information is available to determine the appropriate value of credits for the emission point. Paragraph (c)(5) of this section discusses the use of pollution prevention in generating emissions averaging credits.

* * * * *

(2) Storage vessels, continuous front-end process vents, and process wastewater steams that are determined to be Group 1 emission points and that are controlled by a technology that the Administrator or permitting authority agrees has a higher nominal efficiency than the reference control technology. Information on the nominal efficiencies for such technologies shall be submitted and approved as provided in paragraph (i) of this section.

* * * * *

(5) * * *

(i) For a Group 1 storage vessel, batch front-end process vent, aggregate batch vent stream, continuous front-end process vent, or process wastewater stream, the pollution prevention measure shall reduce emissions more than if the reference control technology or standard had been applied to the emission point instead of the pollution prevention measure, except as provided in paragraph (c)(5)(ii) of this section.

(ii) If a pollution prevention measure is used in conjunction with other controls for a Group 1 storage vessel, batch front-end process vent, aggregate batch vent stream, continuous front-end process vent, or process wastewater stream, the pollution prevention measure alone does not have to reduce emissions more than the reference control technology or standard, but the combination of the pollution prevention measure and other controls shall reduce emissions more than if the applicable reference control technology or standard had been applied instead of the pollution prevention measure.

(d) * * *

(5) Emission points controlled to comply with a State or Federal rule other than this subpart cannot be used to generate credits, unless the level of control has been increased after November 15, 1990 to a level above what is required by the other State or Federal rule. Only the control above what is required by the other State or Federal rule will be credited. However, if an emission point has been used to generate emissions averaging credit in an approved emissions average, and the emission point is subsequently made subject to a State or Federal rule other than this subpart, the emission point may continue to generate emissions averaging credit for the purpose of complying with the previously approved emissions average.

(e) * * *

(3) * * *

(ii) The initial demonstration in the Emissions Averaging Plan or operating permit application that credit-generating emission points will be capable of generating sufficient credits to offset the debits from the debit-generating emission points shall be made under representative operating conditions. After the compliance date, actual operating data will be used for all debit and credit calculations.

* * * * *

(5) Record and report quarterly and annual credits and debits in the Periodic

Reports as specified in § 63.506(e)(6). Every fourth Periodic Report shall include a certification of compliance with the emissions averaging provisions as required by § 63.506(e)(6)(x)(C)(*2*).

* * * * *

(g) * * *

(1) Source-wide debits shall be calculated using Equation 33. Debits and all terms of the equation are in units of megagrams per month (Mg/month):

$$\text{Debits} = \sum_{i=1}^{n}\left(ECFEPV_{iACTUAL} - (0.02)\,ECFEPV_{iu}\right) + \sum_{i=1}^{n}\left(ES_{iACTUAL} - (0.05)\,ES_{iu}\right) + \left(EBEP_{ACTUAL} - EBEP_{c}\right) + \sum_{i=1}^{n}\left(EWW_{iACTUAL} - EWW_{ic}\right) + \sum_{i=1}^{n}\left(EBFEPV_{iACTUAL} - (0.1)\,EBFEPV_{iu}\right) + \sum_{i=1}^{n}\left(EABV_{iACTUAL} - (0.1)\,EABV_{iu}\right) \qquad \text{[Eq. 33]}$$

Where:

$ECFEPV_{iACTUAL}$ = Emissions from each Group 1 continuous front-end process vent i that is uncontrolled or is controlled to a level less stringent than the applicable reference control technology. $ECFEPV_{iACTUAL}$ is calculated according to paragraph (g)(2)(iii) of this section.

$(0.02)ECFEPV_{iu}$ = Emissions from each Group 1 continuous front-end process vent i if the applicable reference control technology had been applied to the uncontrolled emissions. $ECFEPV_{iu}$ is calculated according to paragraph (g)(2)(ii) of this section.

$ES_{iACTUAL}$ = Emissions from each Group 1 storage vessel i that is uncontrolled or is controlled to a level less stringent than the applicable reference control technology or standard. $ES_{iACTUAL}$ is calculated according to paragraph (g)(3) of this section.

$(0.05)ES_{iu}$ = Emissions from each Group 1 storage vessel i if the applicable reference control technology or standard had been applied to the uncontrolled emissions. ES_{iu} is calculated according to paragraph (g)(3) of this section.

$EBEP_{ACTUAL}$ = Emissions from back-end process operations that do not meet the residual organic HAP limits in § 63.494. $EBEP_{ACTUAL}$ is calculated according to paragraph (g)(4)(i) of this section.

$EBEP_{c}$ = Emissions from back-end process operations if the residual organic HAP limits in § 63.494(a) were met. $EBEP_{c}$ is calculated according to paragraph (g)(4)(ii) of this section.

$EWW_{iACTUAL}$ = Emissions from each Group 1 wastewater stream i that is uncontrolled or is controlled to a level less stringent than the applicable reference control technology. $EWW_{iACTUAL}$ is calculated according to paragraph (g)(5) of this section.

EWW_{ic} = Emissions from each Group 1 wastewater stream i if the reference control technology had been applied to the uncontrolled emissions. EWW_{ic} is calculated according to paragraph (g)(5) of this section.

$EBFEPV_{iACTUAL}$ = Emissions from each Group 1 batch front-end process vent stream i that is uncontrolled or is controlled to a level less stringent than the applicable standard. $EBFEPV_{iACTUAL}$ is calculated according to paragraph (g)(6)(ii) of this section.

$(0.1)\,EBFEPV_{iu}$ = Emissions from each Group 1 batch front-end process vent i if the applicable standard had been applied to the uncontrolled emissions. $EBFEPV_{iu}$ is calculated according to paragraph (g)(6)(i) of this section.

$EABV_{iACTUAL}$ = Emissions from each Group 1 aggregate batch vent stream i that is uncontrolled or is controlled to a level less stringent than the applicable standard. $EABV_{iACTUAL}$ is calculated according to paragraph (g)(7)(iii) of this section.

$(0.1)\,EABV_{iu}$ = Emissions from each Group 1 aggregate batch vent stream i if the applicable standard had been applied to the uncontrolled emissions. $EABV_{iu}$ is calculated according to paragraph (g)(7)(ii) of this section.

n = The number of emission points being included in the emissions average.

(2) * * *

(ii) * * *

(A) The values of Q and C_j shall be determined during a performance test conducted under representative operating conditions. The values of Q and C_j shall be established in the Notification of Compliance Status and shall be updated as provided in paragraph (g)(2)(ii)(B) of this section.

* * * * *

(iii) * * *

* * * * *

(B) * * *

(*1*) The percent reduction shall be measured according to the procedures in § 63.116 if a combustion control device is used. For a flare meeting the criteria in § 63.116(a), or a boiler or process heater meeting the criteria in § 63.116(b), the percent reduction shall be 98 percent. If a noncombustion control device is used, percent reduction shall be demonstrated by a performance test at the inlet and outlet of the device, or, if testing is not feasible, by a control design evaluation and documented engineering calculations.

(*2*) For determining debits from Group 1 continuous front-end process vents, product recovery devices shall not be considered control devices and cannot be assigned a percent reduction in calculating $ECFEPV_{iACTUAL}$. The sampling site for measurement of uncontrolled emissions is after the final product recovery device. However, as provided in § 63.113(a)(3), a Group 1 continuous front-end process vent may add sufficient product recovery to raise the TRE index value above 1.0, thereby becoming a Group 2 continuous front-end process vent. Such a continuous front-end process vent would not be a Group 1 continuous front-end process vent and would, therefore, not be included in determining debits under this paragraph.

* * * * *

(3) Emissions from storage vessels shall be calculated using the procedures specified in § 63.150(g)(3).

* * * * *

(5) Emissions from wastewater shall be calculated using the procedures specified in § 63.150(g)(5).

* * * * *

(7) * * *

(ii) * * *

(A) The values of Q and C_j shall be determined during a performance test conducted under representative operating conditions. The values of Q and C_j shall be established in the Notification of Compliance Status and shall be updated as provided in paragraph (g)(7)(ii)(B) of this section.

* * * * *

(h) * * *

(1) Source-wide credits shall be calculated using Equation 41. Credits and all terms of the equation are in units of Mg/month, and the baseline date is November 15, 1990:

$$
\begin{aligned}
\text{Credits} = {} & D\sum_{i=1}^{n}\left((0.02)\ ECFEPV1_{iu} - ECFEPV1_{iACTUAL}\right) + D\sum_{i=1}^{m}\left(ECFEPV2_{iBASE} - ECFEPV2_{iACTUAL}\right) \\
& + D\sum_{i=1}^{n}\left((0.05)\ ES1_{iu} - ES1_{iACTUAL}\right) + D\sum_{i=1}^{m}\left(ES2_{iBASE} - ES2_{iACTUAL}\right) + D\left(EBEP_c - EBEP_{ACTUAL}\right) \\
& + D\sum_{i=1}^{n}\left(EWW1_{ic} - EWW1_{iACTUAL}\right) + D\sum_{i=1}^{m}\left(EWW2_{iBASE} - EWW2_{iACTUAL}\right) \\
& + D\sum_{i=1}^{n}\left((0.1)\ EBFEPV1_{iu} - EBFEPV1_{iACTUAL}\right) + D\sum_{i=1}^{n}\left((0.1)\ EABV1_{iu} - EABV1_{iACTUAL}\right) \\
& + D\sum_{i=1}^{m}\left(EBFEPV2_{iBASE} - EBFEPV2_{iACTUAL}\right) + D\sum_{i=1}^{m}\left(EABV2_{iBASE} - EABV2_{iACTUAL}\right) \qquad \text{[Eq. 41]}
\end{aligned}
$$

Where:

D = Discount factor = 0.9 for all credit generating emission points, except those controlled by a pollution prevention measure: discount factor = 1.0 for each credit generating emission point controlled by a pollution prevention measure (i.e., no discount provided).

$ECFEPV1_{iACTUAL}$ = Emissions for each Group 1 continuous front-end process vent i that is controlled to a level more stringent than the reference control technology. $ECFEPV1_{iACTUAL}$ is calculated according to paragraph (h)(2)(ii) of this section.

$(0.02)ECFEPV1_{iu}$ = Emissions from each Group 1 continuous front-end process vent i if the reference control technology had been applied to the uncontrolled emissions. $ECFEPV1_{iu}$ is calculated according to paragraph (h)(2)(i) of this section.

$ECFEPV2_{iACTUAL}$ = Emissions from each Group 2 continuous front-end process vent i that is controlled. $ECFEPV2_{iACTUAL}$ is calculated according to paragraph (h)(2)(iii) of this section.

$ECFEPV2_{iBASE}$ = Emissions from each Group 2 continuous front-end process vent i at the baseline date. $ECFEPV1_{iBASE}$ is calculated in paragraph (h)(2)(iv) of this section.

$ES1_{iACTUAL}$ = Emissions from each Group 1 storage vessel i that is controlled to a level more stringent than the reference control technology or standard. $ES1_{iACTUAL}$ is calculated according to paragraph (h)(3) of this section.

$(0.05)\ ES1_{iu}$ = Emissions from each Group 1 storage vessel i if the reference control technology had been applied to the uncontrolled emissions. $ES1_{iu}$ is calculated according to paragraph (h)(3) of this section.

$ES2_{iACTUAL}$ = Emissions from each Group 2 storage vessel i that is controlled. $ES2_{iACTUAL}$ is calculated according to paragraph (h)(3) of this section.

$ES2_{iBASE}$ = Emissions from each Group 2 storage vessel i at the baseline date. $ES2_{iBASE}$ is calculated in paragraph (h)(3) of this section.

$EBEP_{ACTUAL}$ = Actual emissions from back-end process operations, Mg/month. $EBEP_{ACTUAL}$ is calculated in paragraph (h)(4)(i) of this section.

$EBEP_c$ = Emissions from back-end process operations if the residual organic HAP limits in § 63.494(a) were met, Mg/month. $EBEP_c$ is calculated in paragraph (h)(4)(ii) of this section.

$EWW1_{iACTUAL}$ = Emissions from each Group 1 wastewater stream i that is controlled to a level more stringent than the reference control technology. $EWW1_{iACTUAL}$ is calculated according to paragraph (h)(5) of this section.

$EWW1_{ic}$ = Emissions from each Group 1 wastewater stream i if the reference control technology had been applied to the uncontrolled emissions. $EWW1_{ic}$ is calculated according to paragraph (h)(5) of this section.

$EWW2_{iACTUAL}$ = Emissions from each Group 2 wastewater stream i that is controlled. $EWW2_{iACTUAL}$ is calculated according to paragraph (h)(5) of this section.

$EWW2_{iBASE}$ = Emissions from each Group 2 wastewater stream i at the baseline date. $EWW2_{iBASE}$ is calculated according to paragraph (h)(5) of this section.

$(0.1)\ EBFEPV1_{iu}$ = Emissions from each Group 1 batch front-end process vent i if the applicable standard had been applied to the uncontrolled emissions. $EBFEPV_{iu}$ is calculated according to paragraph (h)(6)(i) of this section.

$EBFEPV1_{iACTUAL}$ = Emissions from each Group 1 batch front-end process vent i that is controlled to a level more stringent than the applicable standard. $EBFEPV1_{iACTUAL}$ is calculated according to paragraph (h)(6)(ii) of this section.

$(0.1)EABV1_{iu}$ = Emissions from each Group 1 aggregate batch vent stream i if the applicable standard had been applied to the uncontrolled emissions. $EABV1_{iu}$ is calculated according to paragraph (h)(7)(i) of this section.

$EABV1_{iACTUAL}$ = Emissions from each Group 1 aggregate batch vent stream i that is controlled to a level more stringent than the applicable standard. $EABV1_{iACTUAL}$ is calculated according to paragraph (h)(7)(ii) of this section.

$EBFEPV2_{iBASE}$ = Emissions from each Group 2 batch front-end process vent i at the baseline date.

$EBFEPV2_{iBASE}$ is calculated according to paragraph (h)(6)(iv) of this section.

$EBFEPV2_{iACTUAL}$ = Emissions from each Group 2 batch front-end process vent i that is controlled. $EBFEPV2_{iACTUAL}$ is calculated according to paragraph (h)(6)(iii) of this section.

$EABV2_{iBASE}$ = Emissions from each Group 2 aggregate batch vent stream i at the baseline date. $EABV2_{iBASE}$ is calculated according to paragraph (g)(7)(iv) of this section.

$EABV2_{iACTUAL}$ = Emissions from each Group 2 aggregate batch vent stream i that is controlled. $EABV2_{iACTUAL}$ is calculated according to paragraph (h)(7)(iii) of this section.

n = Number of Group 1 emission points included in the emissions average. The value of n is not necessarily the same for continuous front-end process vents, batch front-end process vents, aggregate batch vent streams, storage vessels, wastewater streams, or the collection of process sections within the affected source.

m = Number of Group 2 emission points included in the emissions average. The value of m is not necessarily the same for continuous front-end process vents, batch front-end process vents, aggregate batch vent streams, storage vessels, wastewater streams, or the collection of process sections within the affected source.

* * * * *

(3) Emissions from storage vessels shall be calculated using the procedures specified in § 63.150(h)(3).

* * * * *

(5) Emissions from wastewater streams shall be calculated using the procedures specified in § 63.150(h)(5).

(6) * * *

(ii) Actual emissions from Group 1 batch front-end process vents controlled to a level more stringent than the standard ($EBFEPV1_{iACTUAL}$) shall be calculated using Equation 46, where percent reduction is for the batch cycle: [Equation 46 is unchanged.]

* * * * *

(7) * * *

(ii) Actual emissions from Group 1 aggregate batch vent streams controlled to a level more stringent than the standard ($EABV1i_{ACTUAL}$) shall be calculated using Equation 49:

$$EABV1_{iACTUAL} = EABV1_{iu}\left(1 - \frac{\text{Percent reduction}}{100\%}\right) \quad \text{[Eq. 49]}$$

* * * * *

(i) The following procedures shall be followed to establish nominal efficiencies for emission controls for storage vessels, continuous front-end process vents, and process wastewater streams. The procedures in paragraphs (i)(1) through (i)(6) of this section shall be followed for control technologies that are different in use or design from the reference control technologies and achieve greater percent reductions than the percent efficiencies assigned to the reference control technologies in § 63.111.

(1) In those cases where the owner or operator is seeking permission to take credit for use of a control technology that is different in use or design from the reference control technology, and the different control technology will be used in more than three applications at a single plant-site, the owner or operator shall submit the information specified in paragraphs (i)(1)(i) through (i)(1)(iv) of this section, as specified in § 63.1335(e)(7)(ii), to the Director of the EPA Office of Air Quality Planning and Standards, in writing.

* * * * *

(iii) Documentation demonstrating to the Administrator's satisfaction the control efficiency of the control technology. This may include performance test data collected using an appropriate EPA Method or any other method validated according to Method 301, 40 CFR part 63, appendix A. If it is infeasible to obtain test data, documentation may include a design evaluation and calculations. The engineering basis of the calculation procedures and all inputs and assumptions made in the calculations shall be documented.

* * * * *

(2) The Administrator shall determine within 120 days whether an application presents sufficient information to determine nominal efficiency. The Administrator reserves the right to request specific data in addition to the items listed in paragraph (i)(1) of this section.

(3) The Administrator shall determine within 120 days of the submittal of sufficient data whether a control technology shall have a nominal efficiency and the level of that nominal efficiency. If, in the Administrator's judgment, the control technology achieves a level of emission reduction greater than the reference control technology for a particular kind of emission point, the Administrator will publish a **Federal Register** notice establishing a nominal efficiency for the control technology.

* * * * *

(5) In those cases where the owner or operator is seeking permission to take credit for use of a control technology that is different in use or design from the reference control technology and the different control technology will be used in no more than three applications at a single plant site, the owner or operator shall submit the information listed in paragraph (i)(1)(i) as specified in § 63.506(e)(7)(ii) to the Administrator.

(i) In these instances, use and conditions for use of the control technology may be approved by the permitting authority as part of an operating permit application or modification. The permitting authority shall follow the procedures specified in paragraphs (i)(2) through (i)(4) of this section except that, in these instances, a **Federal Register** notice is not required to establish the nominal efficiency for the different technology.

* * * * *

(j) * * *

(2) The emission reduction efficiency of pollution prevention measures implemented after November 15, 1990, may be used in calculating the actual emissions from an emission point in the debit and credit equations in paragraphs (g) and (h) of this section.

* * * * *

(ii) * * *

(B) For wastewater, E_B shall be calculated according to § 63.150(j)(2)(ii)(B).

* * * * *

(D) The monthly emissions after the pollution prevention measure, E_{pp}, may be determined during a performance test or by a design evaluation and documented engineering calculations. Once an emissions-to-production ratio has been established, the ratio may be used to estimate monthly emissions from monthly production records.

(E) For wastewater, E_{pp} shall be calculated according to § 63.150(j)(2)(ii)(E).

* * * * *

(iv) The same pollution prevention measure may reduce emissions from multiple emission points. In such cases, the percent reduction in emissions for each emission point shall be calculated.

(v) For the purposes of the equations in paragraphs (h)(2) through (h)(7) of this section, used to calculate credits for emission points controlled more stringently than the reference control technology or standard, the nominal efficiency of a pollution prevention measure is equivalent to the percent reduction of the pollution prevention measure. When a pollution prevention measure is used, the owner or operator of an affected source is not required to apply to the Administrator for a nominal efficiency and is not subject to paragraph (i) of this section.

(k) The owner or operator shall demonstrate that the emissions from the emission points proposed to be included in the emissions average will not result in greater hazard, or at the option of the Administrator, greater risk to human health or the environment than if the emission points were controlled according to the provisions in §§ 63.484, 63.485, 63.486, 63.493, and 63.501.

* * * * *

(4) A hazard or risk equivalency demonstration shall:

* * * * *

(m) * * *

(1) * * *

(i) Determine whether the continuous front-end process vent is Group 1 or Group 2 according to the procedures specified in § 63.115 and as required by § 63.485;

(ii) Conduct initial performance tests to determine percent reduction as specified in § 63.116 and as required by § 63.485; and

(iii) Monitor the operating parameters, keep records, and submit reports as specified in §§ 63.114, 63.117(a), and 63.118(a) and (f), as required, for the specific control device as required by § 63.485.

(2) * * *

(i) Determine the flow rate, organic HAP concentration, and TRE index value according to the procedures specified in § 63.115; and

(ii) Monitor the operating parameters, keep records, and submit reports according to the procedures specified in §§ 63.114, 63.117(a), and 63.118(b) and (f), as required, for the specific recovery device, and as required by § 63.485.

(3) * * *

(i) Perform the monitoring or inspection procedures according to the procedures specified in § 63.120, and as required by § 63.484;

(ii) Perform the reporting and recordkeeping procedures according to the procedures specified in §§ 63.122 and 63.123, and as required by § 63.484; and

(iii) For closed vent systems with control devices, conduct an initial design evaluation and submit an operating plan according to the procedures specified in § 63.120(d) and (b), and as required by § 63.484.

(4) * * *

(ii) If a control or recovery device is used to reduce back-end process operation emissions, the owner or operator of the affected source shall comply with §§ 63.496, 63.497, 63.498(d), and the applicable provisions of 63.499, and shall implement the provisions of these sections.

(5) * * *

(i) For wastewater treatment processes, conduct tests according to the procedures specified in § 63.138(i) and (j), and as required by § 63.501;

(ii) Conduct inspections and monitoring according to the procedures specified in § 63.143, and as required by § 63.501;

(iii) Implement a recordkeeping program according to the procedures specified in § 63.147, and as required by § 63.501; and

(iv) Implement a reporting program according to the procedures specified in § 63.146, and as required by § 63.501.

* * * * *

13. Amend § 63.505 by revising paragraph (e)(1)(ii), to read as follows:

§ 63.505 Parameter monitoring levels and excursions.

* * * * *

(e) * * *

(1) * * *

(ii) The residual organic HAP content in each sample is to be determined using Methods specified in § 63.495(e).

* * * * *

14. Amend § 63.506 by revising paragraph (e)(4)(ii)(H)(*1*), to read as follows:

§ 63.506 General recordkeeping and reporting provisions.

* * * * *

(e) * * *

(4) * * *

(ii) * * *

(H) * * *

(*1*) The required documentation shall include the data used to determine whether the wastewater stream is a Group 1 or Group 2 wastewater stream.

* * * * *

Subpart JJJ—National Emission Standards for Hazardous Air Pollutant Emissions: Group IV Polymers and Resins

15. Amend § 63.1311 by revising paragraphs (d)(1)(ii), (d)(1)(iii), and (d)(4), and adding paragraph (d)(1)(iv), to read as follows:

§ 63.1311 Compliance schedule and relationship to existing applicable rules.

* * * * *

(d) * * *

(1) * * *

(ii) A barrier fluid system will be installed;

(iii) A new barrier fluid will be utilized which requires changes to the existing barrier fluid system; or

(iv) The compressor will be modified to permit connecting the compressor to a fuel gas system or a closed vent system or modified so that emissions from the compressor can be routed to a process.

* * * * *

(4) Compliance with the compressor provisions of § 63.164 shall occur not later than September 12, 1999 for any compressor meeting one or more of the criteria in paragraphs (d)(4)(i) through (d)(4)(iii) of this section. The owner or operator who elects to use these provisions shall submit a request for an extension of compliance in accordance with the requirements of paragraph (d)(2)(iv) of this section.

(i) Compliance cannot be achieved without replacing the compressor;

(ii) Compliance cannot be achieved without recasting the distance piece; or

(iii) Design modifications are required to connect to a closed-vent or recovery system.

* * * * *

16. Amend § 63.1312 by adding, in alphabetical order, definitions for "combustion device burner" and "supplemental combustion air," to paragraph (b), to read as follows:

§ 63.1312 Definitions.

* * * * *

(b) * * *

Combustion device burner means a device designed to mix and ignite fuel and air to provide a flame to heat and oxidize waste organic vapors in a combustion device.

* * * * *

Supplemental combustion air means the air that is added to a vent stream after the vent stream leaves the unit operation. Air that is part of the vent stream as a result of the nature of the unit operation is not considered supplemental combustion air. Air required to operate combustion device burner(s) is not considered supplemental combustion air.

* * * * *

17. Amend § 63.1314 by adding paragraph (b)(3), to read as follows:

§ 63.1314 Storage vessel provisions.

* * * * *

(b) * * *

(3) For all other storage vessels designated as Group 1 storage vessels, emissions shall be controlled to the level designated in § 63.119.

* * * * *

18. Amend § 63.1315 by revising paragraph (a) introductory text; adding and reserving paragraphs (a)(16) and (a)(17); and adding paragraphs (a)(18) and (e), to read as follows:

§ 63.1315 Continuous process vents provisions.

(a) For each continuous process vent located at an affected source, the owner or operator shall comply with the requirements of §§ 63.113 through 63.118, with the differences noted in paragraphs (a)(1) through (a)(18) of this section for the purposes of this subpart, except as provided in paragraphs (b) through (e) of this section.

* * * * *

(16) [Reserved]

(17) [Reserved]

(18) When a combustion device is used to comply with the 20 parts per million by volume outlet concentration standard specified in § 63.113(a)(2), the correction to 3 percent oxygen is only required when supplemental combustion air is used to combust the emissions, for the purposes of this subpart. In addition, the correction to 3 percent oxygen specified in § 63.116(c)(3) and (c)(3)(iii) is only required when supplemental combustion air is used to combust the emissions, for the purposes of this subpart. Finally, when a combustion device is used to comply with the 20 parts per million by volume outlet concentration standard specified in § 63.113(a)(2), an owner or operator shall record and report the outlet concentration required in § 63.117(a)(4)(ii) and (a)(4)(iv) corrected to 3 percent oxygen when supplemental combustion air is used to combust the emissions, for the purposes of this subpart. When supplemental combustion air is not used to combust

the emissions, an owner or operator may record and report the outlet concentration required in § 63.117(a)(4)(ii) and (a)(4)(iv) on an uncorrected basis or corrected to 3 percent oxygen, for the purposes of this subpart.

* * * * *

(e) Owners or operators of affected sources producing ASA/AMSAN shall reduce organic HAP emissions from each continuous process vent, each batch process vent, and each aggregate batch vent stream by 98 weight-percent and shall comply with either paragraph (e)(1), (e)(2), or (e)(3), as appropriate. Where batch process vents or aggregate batch vent streams are combined with continuous process vents, the provisions of paragraph (a)(13) of this section shall apply for the purposes of this paragraph (e).

(1) For each continuous process vent, comply with paragraph (a) of this section as specified in paragraphs (e)(1)(i) through (e)(1)(ii) of this section.

(i) For purpose of this section, each continuous process vent shall be considered to be a Group 1 continuous process vent and the owner or operator of that continuous process vent shall comply with the requirements for a Group 1 continuous process vent.

(ii) For purposes of this section, the group determination procedure required by § 63.115 shall not apply.

(2) For each batch process vent, comply with §§ 63.1321 through 63.1327 as specified in paragraphs (e)(2)(i) through (e)(2)(ii) of this section.

(i) For purpose of this section, each batch process vent shall be considered to be a Group 1 batch process vent and the owner or operator of that batch process vent shall comply with the requirements for a Group 1 batch process vent contained in §§ 63.1321 through 63.1327, except that each batch process vent shall be controlled to reduce organic HAP emissions by 98 weight-percent.

(ii) For purposes of this section, the group determination procedure required by § 63.1323 shall not apply.

(3) For each aggregate batch vent stream, comply with §§ 63.1321 through 63.1327 as specified in paragraphs (e)(3)(i) through (e)(3)(ii) of this section.

(i) For purpose of this section, each aggregate batch vent stream shall be considered to be a Group 1 aggregate batch vent stream and the owner or operator of that aggregate batch vent stream shall comply with the requirements for a Group 1 aggregate batch vent stream contained in §§ 63.1321 through 63.1327, except that each aggregate batch vent stream shall be controlled to reduce organic HAP emissions by 98 weight-percent.

(ii) For purposes of this section, the group determination procedure required by § 63.1323 shall not apply.

19. Amend § 63.1316 by revising the section title, paragraphs (b)(1)(i), (b)(1)(ii), (b)(2)(i), and (b)(2)(ii); and adding paragraphs (b)(1)(v) and (b)(2)(v), to read as follows:

§ 63.1316 PET and polystyrene affected sources—emissions control provisions.

* * * * *

(b) * * *

(1) * * *

(i) The owner or operator of an existing affected source with organic HAP emissions greater than 0.12 kg organic HAP per Mg of product from continuous process vents in the collection of material recovery sections (i.e., methanol recovery) within the affected source shall comply with either paragraph (b)(1)(i)(A), (b)(1)(i)(B), or (b)(1)(i)(C) of this section. Emissions from continuous process vents in the collection of material recovery sections within the affected source shall be determined by the procedures specified in § 63.1318(b). The owner or operator of a new affected source shall comply with either paragraph (b)(1)(i)(A), (b)(1)(i)(B), or (b)(1)(i)(C) of this section.

(A) Organic HAP emissions from all continuous process vents in each individual material recovery section shall, as a whole, be no greater than 0.018 kg organic HAP per Mg of product from the associated TPPU(s); or alternatively, organic HAP emissions from all continuous process vents in the collection of material recovery sections within the affected source shall, as a whole, be no greater than 0.018 kg organic HAP per Mg product from all associated TPPU(s);

(B) As specified in § 63.1318(d), the owner or operator shall maintain the daily average outlet gas stream temperature from each final condenser in a material recovery section at a temperature of +3°C (+37°F) or less (i.e., colder); or

(C) Comply with paragraph (b)(1)(v) of this section.

(ii) Limit organic HAP emissions from continuous process vents in the collection of polymerization reaction sections within the affected source by complying with either paragraph (b)(1)(ii)(A) or (b)(1)(ii)(B) of this section.

(A) Organic HAP emissions from all continuous process vents in each individual polymerization reaction section within the affected source (including emissions from any equipment used to further recover ethylene glycol, but excluding emissions from process contact cooling towers) shall, as a whole, be no greater than 0.02 kg organic HAP per Mg of product from the associated TPPU(s); or alternatively, organic HAP emissions from all continuous process vents in the collection of polymerization reaction sections within the affected source shall, as a whole, be no greater than 0.02 kg organic HAP per Mg product from all associated TPPU(s); or

(B) Comply with paragraph (b)(1)(v) of this section.

* * * * *

(v) Comply with one of the following:

(A) Reduce the emissions in a combustion device to achieve 98 weight percent reduction or to achieve a concentration of 20 parts per million by volume (ppmv) on a dry basis, whichever is less stringent. If an owner or operator elects to comply with the 20 ppmv standard, the concentration shall include a correction to 3 percent oxygen only when supplemental combustion air is used to combust the emissions;

(B) Combust the emissions in a boiler or process heater with a design heat input capacity of 150 million Btu/hr or greater by introducing the emissions into the flame zone of the boiler or process heater; or

(C) Combust the emissions in a flare that complies with the requirements of § 63.1333(e).

(2) * * *

(i) Limit organic HAP emissions from continuous process vents in the collection of raw material preparation sections within the affected source by complying with either paragraph (b)(2)(i)(A) or (b)(2)(i)(B) of this section.

(A) Organic HAP emissions from all continuous process vents associated with the esterification vessels in each individual raw materials preparation section shall, as a whole, be no greater than 0.04 kg organic HAP per Mg of product from the associated TPPU(s); or alternatively, organic HAP emissions from all continuous process vents associated with the esterification vessels in the collection of raw material preparation sections within the affected source shall, as a whole, be no greater than 0.04 kg organic HAP per Mg of product from all associated TPPU(s). Other continuous process vents (i.e., those not associated with the esterification vessels) in the collection of raw materials preparation sections within the affected source shall comply with § 63.1315; or

(B) Comply with paragraph (b)(2)(v) of this section.

(ii) Limit organic HAP emissions from continuous process vents in the collection of polymerization reaction sections within the affected source by complying with either paragraph (b)(2)(ii)(A) or (b)(2)(ii)(B) of this section.

(A) Organic HAP emissions from all continuous process vents in each individual polymerization reaction section (including emissions from any equipment used to further recover ethylene glycol, but excluding emissions from process contact cooling towers) shall, as a whole, be no greater than 0.02 kg organic HAP per Mg of product from the associated TPPU(s); or alternatively, organic HAP emissions from all continuous process vents in the collection of polymerization reaction sections within the affected source shall, as a whole, be no greater than 0.02 kg organic HAP per Mg of product from all associated TPPU(s); or

(B) Comply with paragraph (b)(2)(v) of this section.

* * * * *

(v) Comply with one of the following:

(A) Reduce the emissions in a combustion device to achieve 98 weight percent reduction or to achieve a concentration of 20 parts per million by volume (ppmv) on a dry basis, whichever is less stringent. If an owner or operator elects to comply with the 20 ppmv standard, the concentration shall include a correction to 3 percent oxygen only when supplemental combustion air is used to combust the emissions;

(B) Combust the emissions in a boiler or process heater with a design heat input capacity of 150 million Btu/hr or greater by introducing the emissions into the flame zone of the boiler or process heater; or

(C) Combust the emissions in a flare that complies with the requirements of § 63.1333(e).

* * * * *

20. Amend § 63.1321 by adding paragraph (d), to read as follows:

§ 63.1321 Batch process vents provisions.

* * * * *

(d) Owners and operators of affected sources producing ASA/AMSAN shall comply with the provisions of § 63.1315(e).

21. Amend § 63.1322 by revising paragraph (b)(2), to read as follows:

§ 63.1322 Batch process vents—reference control technology.

* * * * *

(b) * * *

(2) For each aggregate batch vent stream, reduce organic HAP emissions by 90 weight percent or to a concentration of 20 parts per million by volume, whichever is less stringent, on a continuous basis using a control device. For purposes of complying with the 20 parts per million by volume outlet concentration standard, the outlet concentration shall be calculated on a dry basis. When a combustion device is used for purposes of complying with the 20 parts per million by volume outlet concentration standard, the concentration shall be corrected to 3 percent oxygen if supplemental combustion air is used to combust the emissions. If supplemental combustion air is not used, a correction to 3 percent oxygen is not required.

* * * * *

22. Amend § 63.1323 by revising paragraph (a)(2), to read as follows:

§ 63.1323 Batch process vents—methods and procedures for group determination.

(a) * * *

(2) The annual uncontrolled organic HAP or TOC emissions and annual average batch vent flow rate shall be determined at the exit from the batch unit operation. For the purposes of these determinations, the primary condenser operating as a reflux condenser on a reactor or distillation column, the primary condenser recovering monomer, reaction products, by-products, or solvent from a stripper operated in batch mode, and the primary condenser recovering monomer, reaction products, by-products, or solvent from a distillation operation operated in batch mode shall be considered part of the batch unit operation. All other devices that recover or oxidize organic HAP or TOC vapors shall be considered control devices as defined in § 63.1312.

* * * * *

23. Amend § 63.1325 by revising paragraph (e) introductory text and adding paragraph (e)(3), to read as follows:

§ 63.1325 Batch process vents—performance test methods and procedures to determine compliance.

* * * * *

(e) *Aggregate batch vent stream testing for compliance with § 63.1322(b)(2) or (b)(3).* Except as specified in paragraphs (e)(1) through (e)(3) of this section, owners or operators of aggregate batch vent streams complying with § 63.1322(b)(2) or (b)(3) shall conduct a performance test using the performance testing procedures for continuous process vents in § 63.116(c).

* * * * *

(3) When a combustion device is used to comply with the 20 parts per million by volume outlet concentration standard specified in § 63.1322(b)(2), the correction to 3 percent oxygen specified in the performance testing procedures of § 63.116(c)(3) and § 63.116(c)(3)(iii) is only required when supplemental combustion air is used to combust the emissions, for the purposes of this subpart.

* * * * *

24. Amend § 63.1326 by revising paragraph (b)(4) introductory text and adding paragraph (b)(5), to read as follows:

§ 63.1326 Batch process vents—recordkeeping provisions.

* * * * *

(b) * * *

(4) The following information when using a control device to meet the percent reduction requirement specified in § 63.1322(a)(2), (a)(3), (b)(2), or (b)(3):

* * * * *

(5) When complying with the 20 parts per million by volume outlet concentration standard specified in § 63.1322(b)(2), records of the outlet concentration of organic HAP or TOC on a dry basis. If supplemental combustion air is used to combust the emissions, the outlet concentration shall be corrected to 3 percent oxygen. If supplemental combustion air is not used, a correction to 3 percent oxygen is not required.

* * * * *

25. Amend § 63.1330 by adding and reserving paragraph (c), and paragraphs (d) and (e), to read as follows:

§ 63.1330 Wastewater provisions.

* * * * *

(c) *[Reserved]*

(d) The provisions of paragraph (b) of this section do not apply to each affected source producing ASA/AMSAN.

(e) The provisions of paragraphs (a), (b), and (c) of this section do not apply to each affected source producing polystyrene using either a continuous or batch process.

26. Amend § 63.1332 by revising paragraphs (a)(2), (a)(3) introductory text, (c) introductory text, (c)(3), (d)(5), (e)(3)(ii), (e)(5), (g)(1), (g)(2)(ii)(A), (g)(7)(ii)(A), (h)(1) introductory text, (h)(6)(ii) introductory text, (h)(7)(ii) introductory text (the equation remains unchanged), (i)(1) introductory text, (i)(1)(iii), (i)(2), (i)(3), (i)(5) introductory text, (i)(5)(i), (j)(2) introductory text, (j)(2)(ii)(B), (j)(2)(iv), (j)(2)(v), (k) introductory text, (k)(4) introductory text, and (l) introductory text, to read as follows:

§ 63.1332 Emissions averaging provisions.

(a) * * *

(2) Compliance with the provisions of this section may be based on either organic HAP or TOC.

(3) For the purposes of these provisions, whenever Method 18, 40 CFR part 60, appendix A, is specified within the paragraphs of this section or is specified by reference through provisions outside this section, Method 18 or Method 25A, 40 CFR part 60, appendix A, may be used. The use of Method 25A, 40 CFR part 60, appendix A, shall conform with the requirements in paragraphs (a)(3)(i) and (a)(3)(ii) of this section.

* * * * *

(c) Paragraphs (c)(1) through (c)(5) of this section describe the emission points that may be used to generate emissions averaging credits if control was applied after November 15, 1990, and if sufficient information is available to determine the appropriate value of credits for the emission point. Paragraph (c)(6) of this section discusses the use of pollution prevention in generating emissions averaging credits.

* * * * *

(3) Storage vessels, continuous process vents subject to § 63.1315, and process wastewater streams that are determined to be Group 1 emission points and that are controlled by a technology that the Administrator or permitting authority agrees has a higher nominal efficiency than the reference control technology. Information on the nominal efficiencies for such technologies shall be submitted and approved as provided in paragraph (i) of this section.

* * * * *

(d) * * *

(5) Emission points controlled to comply with a State or Federal rule other than this subpart cannot be used to generate credits, unless the level of control has been increased after November 15, 1990, to a level above what is required by the other State or Federal rule. Only the control above what is required by the other State or Federal rule will be credited. However, if an emission point has been used to generate emissions averaging credit in an approved emissions average, and the emission point is subsequently made subject to a State or Federal rule other than this subpart, the emission point may continue to generate emissions averaging credit for the purpose of complying with the previously approved emissions average.

(e) * * *

(3) * * *

(ii) The initial demonstration in the Emissions Averaging Plan or operating permit application that credit-generating emission points will be capable of generating sufficient credits to offset the debits from the debit-generating emission points shall be made under representative operating conditions. After the compliance date, actual operating data will be used for all debit and credit calculations.

(4) * * *

(5) Record and report quarterly and annual credits and debits in the Periodic Reports as specified in § 63.1335(e)(6). Every fourth Periodic Report shall include a certification of compliance with the emissions averaging provisions as required by § 63.1335(e)(6)(x)(C)(*2*).

* * * * *

(g) * * *

(1) Source-wide debits shall be calculated using Equation 28 of this subpart. Debits and all terms of Equation 28 of this subpart are in units of megagrams per month:

$$\begin{aligned}\text{Debits} = &\sum_{i=1}^{n}\left(ECPV_{iACTUAL} - (0.02)\ ECPV_{iu}\right) + \sum_{j=1}^{n}\left(ECPVS_{jACTUAL} - ECPVS_{jSTD}\right)\\ &+\sum_{i=1}^{n}\left(ES_{iACTUAL} - (b)\ ES_{iu}\right) + \sum_{i=1}^{n}\left(EWW_{iACTUAL} - EWW_{ic}\right)\\ &+\sum_{i=1}^{n}\left(EBPV_{iACTUAL} - (0.10)\ EBPV_{iu}\right) + \sum_{i=1}^{n}\left(EABV_{iACTUAL} - (0.10)\ EABV_{iu}\right) \qquad \text{[Eq. 28]}\end{aligned}$$

Where:

$ECPV_{iACTUAL}$ = Emissions from each Group 1 continuous process vent i subject to § 63.1315 that is uncontrolled or is controlled to a level less stringent than the applicable reference control technology. $ECPV_{iACTUAL}$ is calculated according to paragraph (g)(2) of this section.

$(0.02)ECPV_{iu}$ = Emissions from each Group 1 continuous process vent i subject to § 63.1315 if the applicable reference control technology had been applied to the uncontrolled emissions. $ECPV_{iu}$ is calculated according to paragraph (g)(2) of this section.

$ECPVS_{jACTUAL}$ = Emissions from Group 1 continuous process vents subject to § 63.1316(b)(1)(i), (b)(1)(ii), (b)(2)(i), (b)(2)(ii), or (c)(1) located in the collection of process sections j within the affected source that are uncontrolled or controlled to a level less stringent than the applicable standard. $ECPVS_{jACTUAL}$ is calculated according to paragraph (g)(3) of this section.

$ECPVS_{jSTD}$ = Emissions from Group 1 continuous process vents subject to § 63.1316(b)(1)(i), (b)(1)(ii), (b)(2)(i), (b)(2)(ii), or (c)(1) located in the collection of process sections j within the affected source if the applicable standard had been applied to the uncontrolled emissions. $ECPVS_{jSTD}$ is calculated according to paragraph (g)(3) of this section.

$ES_{iACTUAL}$ = Emissions from each Group 1 storage vessel i that is uncontrolled or is controlled to a level less stringent than the applicable reference control technology or standard. $ES_{iACTUAL}$ is calculated according to paragraph (g)(4) of this section.

$(BL)ES_{iu}$ = Emissions from each Group 1 storage vessel i if the applicable reference control technology or standard had been applied to the uncontrolled emissions. ES_{iu} is calculated according to paragraph (g)(4) of this section. For calculating emissions, BL = 0.05 for each Group 1 storage vessel i subject to § 63.1314(a); and BL = 0.02 for each storage vessel i subject to § 63.1314(c).

$EWW_{iACTUAL}$ = Emissions from each Group 1 wastewater stream i that is uncontrolled or is controlled to a level less stringent than the applicable reference control technology. $EWW_{iACTUAL}$ is calculated according to paragraph (g)(5) of this section.

EWW_{ic} = Emissions from each Group 1 wastewater stream i if the reference control technology had been applied to the uncontrolled emissions. EWW_{ic} is calculated according to paragraph (g)(5) of this section.

$EBPV_{iACTUAL}$ = Emissions from each Group 1 batch process vent i that is uncontrolled or is controlled to a level less stringent than the applicable standard. $EBPV_{ACTUAL}$ is calculated according to paragraph (g)(6) of this section.

$(0.10)EBPV_{iu}$ = Emissions from each Group 1 batch process vent i if the applicable standard had been applied to the uncontrolled emissions. $EBPV_{iu}$ is calculated according to paragraph (g)(6) of this section.

$EABV_{iACTUAL}$ = Emissions from each Group 1 aggregate batch vent stream i that is uncontrolled or is controlled to a level less stringent than the applicable standard. $EABPV_{iACTUAL}$ is calculated according to paragraph (g)(7) of this section.

$(0.10)EABV_{iu}$ = Emissions from each Group 1 aggregate batch vent stream i if the applicable standard had been applied to the uncontrolled emissions. $EABV_{iu}$ is calculated according to paragraph (g)(7) of this section.

n = The number of emission points being included in the emissions average.

(2) * * *

(ii) * * *

(A) The values of Q and Cj shall be determined during a performance test conducted under representative operating conditions. The values of Q and Cj shall be established in the Notification of Compliance Status and shall be updated as provided in paragraph (g)(2)(ii)(B) of this section.

* * * * *

(7) * * *

(ii) * * *

(A) The values of Q and Cj shall be determined during a performance test conducted under representative operating conditions. The values of Q and Cj shall be established in the Notification of Compliance Status and shall be updated as provided in paragraph (g)(7)(ii)(B) of this section.

* * * * *

(h) * * *

(1) Sourcewide credits shall be calculated using Equation 35 of this subpart. Credits and all terms of Equation 35 of this subpart are in units of megagrams per month, and the baseline date is November 15, 1990:

$$
\begin{aligned}
\text{Credits} = {} & D\sum_{i=1}^{n}\left((0.02)\,ECPV1_{iu} - ECPV1_{iACTUAL}\right) + D\sum_{j=1}^{n}\left(ECPVS1_{jSTD} - ECPVS1_{jACTUAL}\right) \\
& + D\sum_{i=1}^{m}\left(ECPV2_{iBASE} - ECPV2_{iACTUAL}\right) + D\sum_{j=1}^{m}\left(ECPVS2_{jBASE} - ECPVS2_{jACTUAL}\right) \\
& + D\sum_{i=1}^{n}\left((BL)\,ES1_{iu} - ES1_{iACTUAL}\right) + D\sum_{i=1}^{m}\left(ES2_{iBASE} - ES2_{iACTUAL}\right) \\
& + D\sum_{i=1}^{n}\left(EWW1_{ic} - EWW1_{iACTUAL}\right) + D\sum_{i=1}^{m}\left(EWW2_{iBASE} - EWW2_{iACTUAL}\right) \\
& + D\sum_{i=1}^{n}\left((0.10)\,EBPV1_{iu} - EBPV1_{iACTUAL}\right) + D\sum_{i=1}^{n}\left((0.10)\,EABV1_{iu} - EABV1_{iACTUAL}\right) \\
& + D\sum_{i=1}^{m}\left(EBPV2_{iBASE} - EBPV2_{iACTUAL}\right) + D\sum_{i=1}^{m}\left(EABV2_{iBASE} - EABV2_{iACTUAL}\right) \qquad \text{[Eq. 35]}
\end{aligned}
$$

Where:

D = Discount factor = 0.9 for all credit generating emission points except those controlled by a pollution prevention measure; discount factor = 1.0 for each credit generating emission point controlled by a pollution prevention measure (i.e., no discount provided).

$ECPV1_{iACTUAL}$ = Emissions for each Group 1 continuous process vent i subject to § 63.1315 that is controlled to a level more stringent than the reference control technology. $ECPV1_{iACTUAL}$ is calculated according to paragraph (h)(2) of this section.

$(0.02)ECPV1_{iu}$ = Emissions from each Group 1 continuous process vent i subject to § 63.1315 if the applicable reference control technology had been applied to the uncontrolled emissions. $ECPV1_{iu}$ is calculated according to paragraph (h)(2) of this section.

$ECPVS1_{jSTD}$ = Emissions from Group 1 continuous process vents subject to § 63.1316(b)(1)(i), (b)(1)(ii), (b)(2)(i), (b)(2)(ii), or (c)(1) located in the collection of process sections j within the affected source if the applicable standard had been applied to the uncontrolled emissions. $ECPVS1_{jSTD}$ is calculated according to paragraph (h)(3) of this section.

$ECPVS1_{jACTUAL}$ = Emissions from Group 1 continuous process vents subject to § 63.1316(b)(1)(i), (b)(1)(ii), (b)(2)(i), (b)(2)(ii), or (c)(1) located in the collection of process sections j within the affected source that are controlled to a level more stringent than the applicable standard. $ECPVS1_{jACTUAL}$ is calculated according to paragraph (h)(3) of this section.

$ECPV2_{iACTUAL}$ = Emissions from each Group 2 continuous process vent i subject to § 63.1315 that is controlled. $ECPV2_{iACTUAL}$ is calculated according to paragraph (h)(2) of this section.

$ECPV2_{iBASE}$ = Emissions from each Group 2 continuous process vent i subject to § 63.1315 at the baseline date. $ECPV2_{iBASE}$ is calculated according to paragraph (h)(2) of this section.

$ECPVS2_{jBASE}$ = Emissions from Group 2 continuous process vents subject to § 63.1316(b)(1)(i) located in the collection of material recovery sections j within the affected source at the baseline date. $ECPVS2_{jBASE}$ is calculated according to paragraph (h)(3) of this section.

$ECPVS2_{jACTUAL}$ = Emissions from Group 2 continuous process vents subject to § 63.1316(b)(1)(i) located in the collection of material recovery sections j within the affected source that are controlled. $ECPVS2_{jACTUAL}$ is calculated according to paragraph (h)(3) of this section.

$ES1_{iACTUAL}$ = Emissions from each Group 1 storage vessel i that is controlled to a level more stringent than the applicable reference control technology or standard. $ES1_{iACTUAL}$ is calculated according to paragraph (h)(4) of this section.

$(BL)ES1_{iu}$ = Emissions from each Group 1 storage vessel i if the applicable reference control technology or standard had been applied to the uncontrolled emissions. $ES1_{iu}$ is calculated according to paragraph (h)(4) of this section. For calculating these emissions, BL = 0.05 for each Group 1 storage vessel i subject to § 63.1314(a); and BL = 0.02 for each storage vessel i subject to § 63.1314(c).

$ES2_{iACTUAL}$ = Emissions from each Group 2 storage vessel i that is controlled. $ES2_{iACTUAL}$ is calculated according to paragraph (h)(4) of this section.

$ES2_{iBASE}$ = Emissions from each Group 2 storage vessel i at the baseline date. $ES2_{iBASE}$ is calculated according to paragraph (h)(4) of this section.

$EWW1_{iACTUAL}$ = Emissions from each Group 1 wastewater stream i that is controlled to a level more stringent than the reference control technology. $EWW1_{iACTUAL}$ is calculated according to paragraph (h)(5) of this section.

$EWW1_{ic}$ = Emissions from each Group 1 wastewater stream i if the reference control technology had been applied to the uncontrolled emissions. $EWW1_{ic}$ is calculated according to paragraph (h)(5) of this section.

$EWW2_{iACTUAL}$ = Emissions from each Group 2 wastewater stream i that is controlled.

$EWW2_{iACTUAL}$ is calculated according to paragraph (h)(5) of this section.

$EWW2_{iBASE}$ = Emissions from each Group 2 wastewater stream i at the baseline date. $EWW2_{iBASE}$ is calculated according to paragraph (h)(5) of this section.

$(0.10)EBPV1_{iu}$ = Emissions from each Group 1 batch process vent i if the applicable standard had been applied to the uncontrolled emissions. $EBPV1_{iu}$ is calculated according to paragraph (h)(6) of this section.

$EBPV1_{iACTUAL}$ = Emissions from each Group 1 batch process vent i that is controlled to a level more stringent than the applicable standard. $EBPV1_{iACTUAL}$ is calculated according to paragraph (h)(6) of this section.

$(0.10)EABV1_{iu}$ = Emissions from each Group 1 aggregate batch vent stream i if the applicable standard had been applied to the uncontrolled emissions. $EABV1_{iu}$ is calculated according to paragraph (h)(7) of this section.

$EABV1_{iACTUAL}$ = Emissions from each Group 1 aggregate batch vent stream i that is controlled to a level more stringent than the applicable standard. $EABV1_{iACTUAL}$ is calculated according to paragraph (h)(7) of this section.

$EBPV2_{iBASE}$ = Emissions from each Group 2 batch process vent i at the baseline date. $EBPV2_{iBASE}$ is calculated according to paragraph (h)(6) of this section.

$EBPV2_{iACTUAL}$ = Emissions from each Group 2 batch process vent i that is controlled. $EBPV2_{iACTUAL}$ is calculated according to paragraph (h)(6) of this section.

$EABV2_{iBASE}$ = Emissions from each Group 2 aggregate batch vent stream i at the baseline date. $EABV2_{iBASE}$ is calculated according to paragraph (h)(7) of this section.

$EABV2_{iACTUAL}$ = Emissions from each Group 2 aggregate batch vent stream i that is controlled. $EABV2_{iACTUAL}$ is calculated according to paragraph (h)(7) of this section.

n = Number of Group 1 emission points included in the emissions average. The value of n is not necessarily the same for continuous process vents, batch process vents, aggregate batch vent streams, storage vessels, wastewater streams, or the collection of process sections within the affected source.

m = Number of Group 2 emission points included in the emissions average. The value of m is not necessarily the same for continuous process vents, batch process vents, aggregate batch vent streams, storage vessels, wastewater streams, or the collection of process sections within the affected source.

* * * * *

(6) * * *

(ii) Actual emissions from Group 1 batch process vents controlled to a level more stringent than the standard ($EBPV1_{iACTUAL}$) shall be calculated using Equation 40 of this subpart, where percent reduction is for the batch cycle:

$$EBPV1_{iACTUAL} = EBPV1_{iu}\left(1 - \frac{\text{Percent reduction}}{100\%}\right) \qquad \text{[Eq.S 40]}$$

* * * * *

(7) * * *

(ii) Actual emissions from Group 1 aggregate batch vent streams controlled to a level more stringent than the standard ($EABV1_{iACTUAL}$) shall be calculated using Equation 43 of this subpart:

[Equation 43 is unchanged.]

* * * * *

(i) * * *

(1) In those cases where the owner or operator is seeking permission to take credit for use of a control technology that is different in use or design from the reference control technology, and the different control technology will be used in more than three applications at a single plant-site, the owner or operator shall submit the information specified in paragraphs (i)(1)(i) through (i)(1)(iv) of this section, as specified in § 63.1335(e)(7)(ii), to the Director of the EPA Office of Air Quality Planning and Standards in writing:

* * * * *

(iii) Documentation demonstrating to the Administrator's satisfaction the control efficiency of the control technology. This may include performance test data collected using an appropriate EPA Method or any other method validated according to Method 301, 40 CFR part 63, appendix A, of this part. If it is infeasible to obtain test data, documentation may include a design evaluation and calculations. The engineering basis of the calculation procedures and all inputs and assumptions made in the calculations shall be documented.

* * * * *

(2) The Administrator shall determine within 120 days whether an application presents sufficient information to determine nominal efficiency. The Administrator reserves the right to request specific data in addition to the items listed in paragraph (i)(1) of this section.

(3) The Administrator shall determine within 120 days of the submittal of sufficient data whether a control technology shall have a nominal efficiency and the level of that nominal efficiency. If, in the Administrator's judgment, the control technology achieves a level of emission reduction greater than the reference control technology for a particular kind of emission point, the Administrator will publish a **Federal Register** notice establishing a nominal efficiency for the control technology.

* * * * *

(5) In those cases where the owner or operator is seeking permission to take credit for use of a control technology that is different in use or design from the reference control technology and the different control technology will be used in no more than three applications at a single plant site, the owner or operator shall submit the information listed in paragraphs (i)(1)(i) through (i)(1)(iv) of this section, as specified in § 63.1335(e)(7)(ii), to the Administrator.

(i) In these instances, use and conditions for use of the control technology may be approved by the permitting authority as part of an operating permit application or modification. The permitting authority shall follow the procedures specified in paragraphs (i)(2) through (i)(4) of this section except that, in these instances, a **Federal Register** notice is not required to establish the nominal efficiency for the different technology.

* * * * *

(j) * * *

(2) The emission reduction efficiency of pollution prevention measures implemented after November 15, 1990, may be used in calculating the actual emissions from an emission point in the debit and credit equations in paragraphs (g) and (h) of this section.

* * * * *

(ii) * * *

(B) For wastewater, E_B shall be calculated using Equation 47 of this subpart:

$$E_B = \sum_{i=1}^{n}\left[\left(6.0*10^{-8}\right) Q_{Bi} H_{Bi} \sum_{m=1}^{s} Fe_m HAP_{Bim}\right] \quad \text{[Eq. 47]}$$

Where:

n = Number of wastewater streams.

Q_{Bi} = Annual average flow rate for wastewater stream i before the pollution prevention measure, defined and determined according to § 63.144(c)(3), liters per minute, before implementation of the pollution prevention measure.

H_{Bi} = Number of hours per month that wastewater stream i was discharged before the pollution prevention measure, hours per month.

s = Total number of organic HAP in wastewater stream i.

F_{em} = Fraction emitted of organic HAP m in wastewater from Table 34 of subpart G of this part, dimensionless.

HAP_{Bim} = Annual average concentration of organic HAP m in wastewater stream i, defined and determined according to paragraph § 63.150(g)(5)(i) of this section, before the pollution prevention measure, parts per million by weight, as measured before the implementation of the pollution measure.

* * * * *

(iv) The same pollution prevention measure may reduce emissions from multiple emission points. In such cases, the percent reduction in emissions for each emission point shall be calculated.

(v) For the purposes of the equations in paragraphs (h)(2) through (h)(7) of this section used to calculate credits for emission points controlled more stringently than the reference control technology or standard, the nominal efficiency of a pollution prevention measure is equivalent to the percent reduction of the pollution prevention measure. When a pollution prevention measure is used, the owner or operator of an affected source is not required to apply to the Administrator for a nominal efficiency and is not subject to paragraph (i) of this section.

(k) The owner or operator shall demonstrate that the emissions from the emission points proposed to be included in the emissions average will not result in greater hazard or, at the option of the Administrator, greater risk to human health or the environment than if the emission points were controlled according to the provisions in §§ 63.1314, 63.1315, 63.1316 through 63.1320, 63.1321, and 63.1330.

* * * * *

(4) A hazard or risk equivalency demonstration shall:

* * * * *

(l) For periods of parameter monitoring excursions, an owner or operator may request that the provisions of paragraphs (l)(1) through (l)(4) of this section be followed instead of the procedures in paragraphs (f)(2)(i) and (f)(2)(ii) of this section.

* * * * *

27. Amend § 63.1335 by revising paragraph (e)(4)(ii)(L)(*1*), to read as follows:

§ 63.1335 General recordkeeping and reporting provisions.

* * * * *

(e) * * *

(4) * * *

(ii) * * *

(L) * * *

(*1*) The required documentation shall include the data used to determine whether the wastewater stream is a Group 1 or Group 2 wastewater stream.

* * * * *

28. Revise Tables 3 and 5 to subpart JJJ of Part 63, to read as follows:

* * * * *

TABLE 3 OF SUBPART JJJ.—GROUP 1 STORAGE VESSELS AT EXISTING AFFECTED SOURCES PRODUCING THE LISTED THERMOPLASTICS

Thermoplastic	Chemical [a]	Vessel capacity (cubic meters)	Vapor pressure [b] (kilopascals)
ASA/AMSAN [c]	styrene/acrylonitrile mixture	≥ 3.78	≥ 0.47
	acrylonitrile	≥ 75.7	≥ 1.62
Polystyrene, continuous processes	all chemicals	<75.7	≥ 14.2
		≥ 75.7	
			≥ 1.9
Nitrile [c]	acrylonitrile	≥ 13.25	≥ 1.8

[a] Vessel capacity and vapor pressure criteria are specific to the listed chemical or to "all chemicals," as indicated.
[b] Maximum true vapor pressure of total organic HAP at storage temperature.
[c] The applicability criteria in Table 2 of this subpart shall be used for chemicals not specifically listed in this table (i.e., Table 3).

* * * * *

TABLE 5 OF SUBPART JJJ.—GROUP 1 STORAGE VESSELS AT NEW AFFECTED SOURCES PRODUCING THE LISTED THERMOPLASTICS

Thermoplastic	Chemical [a]	Vessel capacity (cubic meters)	Vapor pressure [b] (kilopascals)
ASA/AMSAN [c]	Styrene/ acrylonitrile mixture	≥ 3.78	≥ 0.47
	Acrylonitrile	≥ 75.7	≥ 1.62
SAN, continuous [d]	All chemicals	≥ 2,271	≥ 0.5 and < 0.7
		< 151	≥ 10
		≥ 151	≥ 0.7
Nitrile [c]	Acrylonitrile	≥ 13.25	≥ 1.8
Polystyrene, continuous processes	All chemicals	≥ 19.6 and <45.4	≥ 7.48
		≥ 45.4 and <109.8	≥ 0.61
		≥ 109.8	≥ 0.53

TABLE 5 OF SUBPART JJJ.—GROUP 1 STORAGE VESSELS AT NEW AFFECTED SOURCES PRODUCING THE LISTED THERMOPLASTICS—Continued

Thermoplastic	Chemical [a]	Vessel capacity (cubic meters)	Vapor pressure [b] (kilopascals)
ABS, continuous mass	Styrene	≥ 45.43	≥ 0.078
	All other chemicals	≥ 38 and < 45.43	≥ 13.1
		≥ 45.43	≥ 0.53

[a] Vessel capacity and vapor pressure criteria are specific to the listed chemical, to "all chemicals," or to "all other chemicals," as indicated.
[b] Maximum true vapor pressure of total organic HAP at storage temperature.
[c] The applicability criteria in Table 4 of this subpart shall be used for chemicals not specifically listed in this table (i.e., Table 5).
[d] The control level for the first two sets of applicability criteria are specified in 63.1314 as 90% and 98%, respectively. The control level for the third set of applicability criteria is the HON control level of 95%.

* * * * *

[FR Doc. 99–3799 Filed 3–8–99; 8:45 am]

BILLING CODE 6560–50–P

a very highly liquid cash market, an exchange bylaw, regulation or resolution requiring traders to provide information about their position upon request by the exchange;

(2) For futures and option contracts on a financial instrument or product or on an intangible commodity having an average moth-end open interest of 50,000 and an average daily volume of 25,000 contracts and a highly liquid cash market, an exchange bylaw, regulation or resolution requiring traders to provide information about their position upon request by the exchange and to consent to halt increasing further a trader's positions if so ordered by the exchange;

(3) For futures and option contracts on a tangible commodity, including but not limited to metals, energy products, or international soft agricultural products, having an average month-end open interest of 50,000 contracts and an average daily volume of 5,000 contracts and a liquid cash market, an exchange bylaw, regulation or resolution requiring traders to provide information about their position upon request by the exchange and to consent to halt increasing further a trader's positions if so ordered by the exchange, *provided, however*, such contract markets are not exempt from the requirement of paragraphs (b) or (c) that they adopt an exchange bylaw, regulation or resolution setting a spot month speculative position limit with a level no grater than one quarter of the estimated spot month deliverable supply;

(4) For purposes of this paragraph, trading volume and open interest shall be calculated by combining the month-end futures and its related option contract, on a delta-adjusted basis, for all months listed during the most recent calendar year.

(f) *Other exemptions.* Exchange speculative position limits adopted pursuant to this section shall not apply to any position acquired in good faith prior to the effective date of any bylaw, rule, regulation, or resolution which specifies such limit or to a person that is registered as a futures commission merchant or as a floor broker under authority of the Act except to the extent that transactions made by such person are made on behalf of or for the account or benefit of such person. In addition to the express exemptions specified in this section, a contract market may propose such other exemptions from the requirements of this section consistent with the purposes of this section and shall submit such rules Commission review under section 5a(1)(12) of the Act and § 1.41(b) of this chapter.

(g) *Aggregation.* In determining whether any person has exceeded the limits established under this section, all positions in accounts for which such person by power of attorney or otherwise directly or indirectly controls trading shall be included with the positions held by such person; such limits upon positions shall apply to positions held by two or more person acting pursuant to an express or implied agreement or understanding, the same as if the positions were held by a single person.

Issued by the Commission this 27th day of April, 1999, in Washington, DC.

Jean A. Webb,

Secretary of the Commission.

[FR Doc. 99–11066 Filed 5–4–99; 8:45 am]

BILLING CODE 6351–01–M

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 60

Standards of Performance for New Stationary Sources

CFR Correction

In Title 40 of the Code of Federal Regulations, part 60, revised as of July 1, 1998, § 60.41c is corrected by adding the following definitions:

§ 60.41c Definitions.

* * * * *

Coal means all solid fuels classified as anthracite, bituminous, subbituminous, or lignite by the American Society for Testing and Materials in ASTM D388–77, "Standard Specification for Classification of Coals by Rank" (incorporated by reference—see § 60.17); coal refuse; and petroleum coke. Synthetic fuels derived from coal for the purpose of creating useful heat, including but not limited to solvent-refined coal, gasified coal, coal-oil mixtures, and coal-water mixtures, are included in this definition for the purposes of this subpart.

Coal refuse means any by-product of coal mining or coal cleaning operations with an ash content greater than 50 percent (by weight) and a heating value less than 13,900 kilojoules per kilogram (kJ/kg) (6,000 Btu per pound (Btu/lb) on a dry basis.

Cogeneration steam generating unit means a steam generating unit that simultaneously produces both electrical (or mechanical) and thermal energy from the same primary energy source.

Combined cycle system means a system in which a separate source (such as a stationary gas turbine, internal combustion engine, or kiln) provides exhaust gas to a steam generating unit.

* * * * *

[FR Doc. 99–55518 Filed 5–4–99; 8:45 am]

BILLING CODE 1505–01–D

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 226

[Docket No. 971029257–9101–02; I.D. 101097A]

RIN 0648–AG56

Designated Critical Habitat; Central California Coast and Southern Oregon/Northern California Coasts Coho Salmon

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration, Commerce.

ACTION: Final rule and correction.

SUMMARY: NMFS is designating critical habitat for two Evolutionarily Significant Units (ESUs) of coho salmon (*Oncorhynchus kisutch*) pursuant to the Endangered Species Act of 1973 (ESA). Critical habitat for the Central California Coast ESU encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between Punta Gorda and the San Lorenzo River (inclusive) in California, including two streams entering San Francisco Bay: Arroyo Corte Madera Del Presidio and Corte Madera Creek. Critical habitat for the Southern Oregon/Northern California Coasts ESU encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon, inclusive.

The areas described in this final rule represent the current freshwater and estuarine range of the listed species. For both ESUs, critical habitat includes all waterways, substrate, and adjacent riparian zones below longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). After considering public comments and reviewing additional scientific information, NMFS is modifying various aspects of the proposed designation, including a revised description of adjacent riparian zones and the exclusion of tribal lands from critical habitat. NMFS has identified several dams in the range of these ESUs that currently block access to habitats

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 60

[FRL–6337–1]

RIN 2060–AH97

Test Methods: Three New Methods for Velocity and Volumetric Flow Rate Determination in Stacks or Ducts

AGENCY: Environmental Protection Agency (EPA).

ACTION: Direct final rule.

SUMMARY: EPA is taking direct final action to approve three new optional test methods for measuring velocity and volumetric flow rate of flue gas from fossil fuel-fired boilers and turbines. These new methods allow the tester to account for velocity drop-off near the stack or duct wall and the yaw and pitch angles of flow. The primary users of the new methods will be owners and operators of utility units subject to the Acid Rain Program under title IV of the Clean Air Act, and certain large electric generating units and large non-electric generating units that may become subject to the nitrogen oxides (NO_X) state implementation plan (SIP) call under Title I of the Clean Air Act, who must use an approved test method to periodically calibrate the flow rate monitors at these units. Flow rate data is used to determine the units' sulfur dioxide (SO_2) and NO_X mass emissions and heat inputs. The purpose of the Acid Rain Program and the NO_X SIP call is to significantly reduce emissions from electric generating plants and other affected units in order to reduce the adverse health and environmental effects of acid deposition or ground level ozone resulting from these emissions.

The sources affected by this action are primarily in the sector Fossil Fuel Electric Power Generation, North American Industrial Classification System (NAICS) code 221112, or are industrial boilers. The affected sources include U.S. industry establishments primarily engaged in operating fossil fuel powered electric power generation facilities. These facilities use fossil fuels, such as coal, oil, or gas, in boilers and combustion turbines to produce electric energy or steam. The electric energy produced in these establishments are provided to electric power transmission systems or to electric power distribution systems.

DATES: This rule is effective on July 13, 1999 without further notice, unless EPA receives adverse comment by June 14, 1999, or (if a public hearing is requested) by July 1, 1999. If we receive such comment, we will publish a timely withdrawal in the **Federal Register** informing the public that this rule will not take effect.

ADDRESSES: Any written comments must be identified with Docket No. A–99–14, must be identified as comments on the direct final rule and companion proposal and must be submitted in duplicate to: EPA Air Docket (6102), Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460. The docket is available for public inspection and copying between 8:30 a.m. and 3:30 p.m., Monday through Friday, at the address given above. A reasonable fee may be charged for copying. A detailed rationale for today's action is set forth in the Findings Report, which can be obtained by writing to the Air Docket at the address given above.

FOR FURTHER INFORMATION CONTACT: John Schakenbach, Acid Rain Division (6204J), U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, (202) 564–9158; or Elliot Lieberman, Acid Rain Division (6204J), U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, (202) 564–9136.

SUPPLEMENTARY INFORMATION: EPA is publishing this rule without prior proposal because we view these new test methods as noncontroversial and anticipate no adverse comment. We believe the rule is not controversial for the following reasons: (1) The rule is primarily technical in nature, (2) the rule is generally accepted by the scientific community, and (3) use of the new test methods will be optional. However, we are publishing a separate document that will serve as the proposal to approve the test methods if adverse comments are filed. This rule will be effective on July 13, 1999 without further notice unless we receive adverse comment by June 14, 1999 or (if a public hearing is requested) by July 1, 1999. If EPA receives timely adverse comment, we will publish a withdrawal in the **Federal Register** informing the public that the rule will not take effect. We will address all public comments in a subsequent final rule based on the proposed rule. We will not institute a second comment period on this action. Any parties interested in commenting must do so at this time.

II. Regulated Entities

Entities potentially regulated by this action are utility and industrial fossil fuel-fired boilers and turbines that serve generators producing electricity, generate steam, or cogenerate electricity and steam and that are subject to EPA's monitoring regulations, 40 CFR part 75. While part 75 primarily regulates the electric utility industry, today's action could potentially affect other industries, including those subject to the NO_X SIP call. Regulated categories and entities include:

Category	Examples of regulated entities
NAICS Code: 221112, Fossil Fuel Electric Power Generation	Electric service providers, boilers and turbines from a wide range of industries.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table lists the types of entities which EPA is now aware could potentially be regulated by this action. Other types of entities not listed in the table could also be regulated. To determine whether your facility, company, business, organization, etc., is regulated by this action, you should carefully examine the applicability criteria in §§ 72.6, 72.7, 72.8, 75.70, and Appendix A of part 60 of title 40 of the Code of Federal Regulations. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding "For Further Information Contact" section of this preamble.

II. Background

In 1971, EPA promulgated Method 2 "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)". At the time of its development, Method 2 was principally used with EPA Method 5 "Determination of Particulate Emissions from Stationary Sources" to help ensure appropriate sampling rates throughout a particulate sampling run.

Many EPA air quality regulations use Method 2, including part 75 of EPA's Acid Rain Program regulations, implementing title IV of the Clean Air

Act (the Act), and part 51 of EPA's NOx SIP call, which may result in states or EPA requiring certain large electric generating units and large non-electric generating units to comply with subpart H of part 75. *See* 40 CFR parts 51 and 75; and 63 FR 57356, 57495, October 27, 1998. Part 75 requires affected electric utility units to install and operate continuous emission monitoring systems that provide EPA with continuous hourly measurements of sulfur dioxide (SO_2) concentration, NO_X concentration, carbon dioxide concentration, and volumetric flow rate of flue gas in a stack or duct. Under the Acid Rain Program, volumetric flow rate and SO_2 concentration are used to calculate sulfur dioxide mass emissions at each affected unit. At the end of each year, these emissions are compared to the unit's sulfur dioxide allowances to determine whether the unit held enough allowances to cover its emissions. Volumetric flow rate is also used to calculate a unit's heat input. In order to ensure the accuracy of compliance determinations, part 75 requires owners and operators of a unit to conduct periodic performance testing of volumetric flow rate monitors by comparing flow rate data from the monitors with data reported using EPA's Method 2. Similarly, subpart H of part 75 uses Method 2 as the reference method for flow rate measurements used to calculate NO_X mass emissions. *See* also 40 CFR part 96.

In the first three years of the Acid Rain Program, the electric utility industry raised concerns that under some flow conditions EPA's approved test method for volumetric flow rate (Method 2) could be less than optimal for measuring flow rate and thus for determining sulfur dioxide emissions and heat input. These concerns focused on situations where flue gas flowed at an angle (i.e., with yaw or pitch), not straight out of a stack or duct. Method 2 does not include procedures for measuring the yaw or pitch angles of flow or wall effects in calculating stack or duct gas velocity or volumetric flow rate.

Volumetric flow rate is calculated by multiplying the average flue gas velocity by the stack or duct cross-sectional area. Yaw and pitch characterize the extent to which flue gas is not flowing straight out of a stack or duct. From the standpoint of a tester facing a vertical stack, a yaw angle is represented by flow movement to the left or right of the stack centerline. The pitch angle is represented by flow movement toward or away from the tester. The term "wall effects" refers to the drop-off of flue gas velocity near the inside wall of a stack or duct. This velocity drop-off is caused by friction from the stack wall.

Some amount of yaw and pitch angle and wall effects are almost always present in utility stacks or ducts. Yaw and pitch angles produce flue gas flow that swirls and/or bounces off stack or duct walls (total velocity). Only the straight-up (axial velocity) component of total velocity actually exits the stack. Moreover, determining axial velocity without accounting for the drop-off near the stack or duct wall can result in overstating the actual axial velocity. Thus, when enough yaw, pitch or wall effects are present, Method 2 can overstate the measured flue gas velocities (and thus volumetric flow) because it only allows the total velocity to be measured and does not account for yaw angles, pitch angles, or wall effects. If the test method overstates flow rate, a flow rate monitor calibrated using the test method may also overstate flow rate and result in overstated sulfur dioxide emissions and heat input.

To address these concerns, and to provide a technical basis for potential new test methods, EPA initiated a flow study consisting of wind tunnel tests and field tests. Wind tunnel tests were performed to ensure accurate probe calibrations, to determine probe performance under different temperature conditions (Reynolds number testing), and to determine probe performance under different flow angle conditions (swirl tunnel testing). Probe calibrations were performed at three wind tunnel facilities: the North Carolina State University (NCSU), the National Institute of Standards and Technology, and the Massachusetts Institute of Technology (MIT). The Reynolds number testing was conducted at MIT. The swirl tunnel testing was performed by the Fossil Energy Research Corporation at a special wind tunnel installation developed for the Electric Power Research Institute.

In addition, field tests were performed to evaluate new techniques that could improve the ability to measure flow rate under a wide range of conditions and to provide a technical basis for potential, new test methods. Field tests were performed at two natural gas-fired 750 MWe electric utility boilers and at a 640 MWe bituminous coal-fired utility boiler. These three sites were selected to provide three different flow swirl conditions. Four test teams were used at each site to perform simultaneous testing of various probes. In this manner, probes could be tested under essentially the same conditions. Seven different probes types were tested: Type S, United Sciences Testing Incorporated Autoprobe Type S, Prandtl (Standard Pitot), French, modified Kiel, DAT, and spherical. A Codel flow monitor was also tested.

A special series of tests were also performed to investigate velocity drop-off near stack walls. These wall effects tests were performed at five sites. The sites were selected to provide different inside stack wall material (steel and brick and mortar) and stack gas flow conditions in order to test how these parameters affect stack gas velocity drop-off near the stack wall.

As a result of the wind tunnel tests and field tests, a report describing results of the wind tunnel testing, three Site Data Reports, describing test activities and results at each site, and the Findings Report, describing overall conclusions, were written. These reports are included in the docket. Significant findings from the wind tunnel and field tests are:

- Probes that could determine the yaw and pitch angles of flow produced results closer to those predicted by scientific theory;
- Overall, the Type S, Autoprobe Type S, DAT, and spherical probes produced the best results: they tended to be less variable, did not consistently under-measure velocity, and were closer to theoretically derived results and the central tendency of the data than the other probes tested;
- Automated probes were less variable than manually operated probes;
- Several probes (modified Kiel, and the French) and the Codel flow monitor produced highly variable test results and should not be included in new test methods;
- Measuring wall effects produced a ½% to 3% improvement in volumetric flow rate measurements.
- The amount of wall effect is lower for stacks with smooth interiors (steel) than for stacks with rougher interiors (brick and mortar);
- To produce reliable probe calibrations, wind tunnels should meet certain specifications related to tunnel size and flow conditions;
- Calibration curves for three-dimensional (3–D) probes, i.e., DAT and the spherical probes, are less reliable for velocities below 20 feet per second; and
- Contrary to expectations, scratches on the surface of spherical probes did not significantly effect their calibrations.

We used these data and findings to develop the three new test methods described in today's rulemaking.

Review by independent experts, industry experts, and EPA experts was used in the three major phases of the flow study: The field test plan, the draft Findings Report, and the three draft test methods. One significant comment by the reviewers was that we should keep the new test methods as effective and practical as possible, but still provide flexibility and a wide range of options for stack testers. Based on reviewer feedback on subsequent versions of the test methods, we believe we have accommodated all major concerns.

III. Approval of Three New Test Methods

Today's direct final rule approves three new test methods that provide probes and procedures to account for yaw angles, pitch angles and wall effects. Method 2G allows Type S probes and 3–D probes (DAT and spherical) to be rotated into the flow to measure total velocity pressure and yaw angle. The yaw angle is used to calculate "near-axial" velocity from total velocity. Method 2F allows 3–D probes to be used to measure total velocity, yaw angles, and pitch angle pressure. Pitch angle pressure is used with a calibration curve to determine pitch angle. Yaw and pitch angles are used to calculate axial velocity from total velocity. Method 2H provides a procedure for accounting for wall effects by using either a default wall effects adjustment factor or one derived from near wall measurements. The wall effects adjustment factor is used with the Method 2-, 2G- or 2F-calculated velocity to derive a wall effects adjusted velocity.

In the Acid Rain Program, and in other programs which require reporting of mass emission rates (e.g., lbs NO_x/hour), a capability to measure these parameters in the calculation of volumetric flow rate can improve the reporting of pollutant emissions in some situations (described earlier). In addition, the new test methods in today's rulemaking address the disparity that has sometimes been reported between heat rate calculated using a flow monitor and heat rate calculated using fuel sampling and analysis to the extent that the disparity results from the difficulty of measuring flue gas flow rate under certain flow conditions. This rule does not address the procedures used in fuel sampling or in the calculation of heat rate.

EPA is voluntarily undertaking this regulatory action in response to requests from the regulated community. This regulatory action provides additional accepted scientific and analytical methods for measuring volumetric flow rate in stacks and ducts The additional test methods are the result of extensive field studies that were subjected to review by a panel of independent experts, utility company representatives, and internal EPA staff. These new test methods may be used instead of Method 2 in programs that use part 75 or part 96 procedures to quantify emissions. These new test methods are discussed below in detail.

A. *Methods 2F and 2G*

Method 2F, "Determination of Stack Gas Velocity and Volumetric Flow Rate With Three-Dimensional Probes", is a method for measuring the yaw and pitch angle-adjusted (or axial) velocity with 3-dimensional probes like the prism-shaped, five-hole probe (commonly called a DA or DAT probe) and the five-hole spherical probe. Method 2G, "Determination of Stack Gas Velocity and Volumetric Flow Rate With Two-Dimensional Probes", is a variant of existing Method 2 that describes the use of yaw angle determination procedures with Type S or 3-dimensional probes to determine the yaw angle-adjusted flue gas velocity in a stack or duct.

The methods include step-by-step procedures specifically designed to provide quality assured measurements and address a number of key problems uncovered in the course of the wind tunnel and field testing of the new methods. The following summarizes the major steps for performing Method 2F or 2G.

(1) Qualify Wind Tunnel

The wind tunnel tests revealed that some wind tunnels used by vendors or source testers to calibrate probes were inadequate, because they were either too small or did not have uniform flow. To avoid such problems, any wind tunnel used to calibrate probes for Methods 2F or 2G must satisfy certain design and performance specifications to ensure that the flow is axial (straight) and uniform in the wind tunnel calibration location. The wind tunnel must meet two design criteria: (1) The diameter must be at least 12 inches; and (2) the projected area of the tested probe and reference calibration pitot tube must not exceed 4% of the cross-sectional area of the wind tunnel. The wind tunnel must also meet two performance specifications: (1) A velocity pressure cross-check to ensure that the velocity is the same at all locations where the tested and reference probes will be positioned during calibration; and (2) an axial flow verification to ensure that there are no significant yaw or pitch components of flow at these locations. These two tests are performed before the initial use of the wind tunnel and are repeated after any alterations are made to the tunnel.

(2) Prepare To Calibrate Probe

The wind tunnel and field tests also showed that pre-calibration probe inspection and procedures for placing a scribe line on a probe were important prerequisites for accurate yaw angle measurements. Therefore, the methods include the following five general activities to be performed prior to calibrating a probe (1) Put a straight permanent line (scribe line) on the probe. This activity only needs to be performed once, not every time a probe is calibrated. The scribe line must meet certain straightness and width criteria so that a yaw angle measuring device can be accurately placed on the probe. (2) Check that the probe is not bent and does not have significant sag. (3) Pressure devices must be zeroed and calibrated. (4) The yaw angle measurement device must be calibrated and aligned relative to the reference scribe line. (5) The probe system must be leak checked.

(3) Perform Yaw Angle Calibration

Yaw angle errors were observed in the wind tunnel tests when the offset of the scribe line from the probe's zero yaw position was not accurately determined in the wind tunnel. The methods, therefore, include a yaw angle calibration procedure, which must be performed on the complete probe assembly in a wind tunnel to determine the "reference scribe line rotational offset" angle (R^{slo}). The R^{slo} indicates the rotational position of a probe's reference scribe line relative to the probe's yaw-null position and is used in determining the yaw angle of flow in a stack or duct.

(4) Perform Velocity and Pitch Calibrations

The field and wind tunnel tests showed that robust velocity and pitch calibration procedures were required if errors in velocity and volumetric flow determinations are to be avoided. For Method 2G, this consists of a wind tunnel procedure to determine a velocity calibration coefficient for the tested probe. This calibration coefficient is used to calculate stack gas velocity from pressure measurements taken in the field. The velocity calibration procedure involves taking three pairs of pressure measurements with the tested probe and a reference calibration pitot tube at two wind tunnel velocity settings. Calibration coefficients obtained at wind tunnel velocity settings of 60 and 90 feet per second (fps) are usable in all field applications where the velocities are 30 fps or greater. Calibration coefficients derived at other velocity settings are usable in field applications where the measured velocity does not fall outside the limits defined by those velocity settings.

Method 2F includes wind tunnel procedures to determine both velocity and pitch angle calibration curves. These curves are used to determine both the pitch angle and velocity of flue gas flow when using a 3-dimensional probe. The pitch and velocity calibration procedure involves positioning the tested probe at a series of pitch angles settings relative to the flow in the wind tunnel and then taking pressure measurements with the tested probe and a reference probe. The measurements are repeated at two wind tunnel velocity settings. Calibration curves obtained at wind tunnel velocity settings of 60 and 90 fps are usable in all field applications over the entire velocity range allowed by the method. Calibration curves derived at other velocity settings are usable in all field applications allowed by the method as long as the measured velocity does not exceed both of the wind tunnel velocity settings used to derive the curves.

(5) Prepare for Field Test

The field tests showed that the inspection of probes and the set-up procedures described above under step 2 were not only a critical prerequisite for wind tunnel testing, but were equally important in field testing. For example, during one of the field tests, an inspection detected damage to the probe head which resulted in spurious readings from a probe. Thus, prior to beginning a field test, each method requires performance of all the checks described in item 2 ("Prepare to Calibrate Probe") above, except for putting a scribe line on the probe. Additionally, the tester must inspect the probe for damage, mark traverse point distances on the probe, and determine a system response time.

(6) Perform Field Test

The field tests also showed that the quality of measurements was affected by procedures followed by testers when performing the field tests. For example, allowing sufficient response time and checking for probe plugging were shown to be important considerations during the field test. Thus, the methods give specific instructions on how to perform a field test. In particular, the methods instruct testers to perform the following steps. Insert the probe into a test port in the stack or duct, and move the probe to the first traverse point. After the system response time has elapsed, measure the yaw angle, impact pressure, and pitch angle pressure (Method 2F only). Take these measurements at each traverse point of the run. In addition, measure barometric pressure, flue gas molecular weight, moisture and static pressure. Check the probe periodically for plugging to prevent erratic results or sluggish responses.

(7) Perform Calculations

To account for pitch and yaw components of flow, the methods had to include new calculation procedures that were not needed in Method 2. These procedures were employed in the field tests and shown to be workable. They include calculating the pitch angle (Method 2F only) and impact velocity at each traverse point using the pressure measurements taken in the field and the calibration coefficient (Method 2G) or curves (Method 2F) derived in the wind tunnel. Using these values and the yaw angles measured in the field, the axial velocity (Method 2F) or yaw-adjusted velocity (Method 2G) is calculated at each traverse point. Stack or duct average velocity is then calculated by averaging over all the traverse point velocities. Checks are performed to see that the calibration coefficients or curves are appropriate for the velocity encountered in the field. Finally, the volumetric flow rate is derived by multiplying the stack or duct cross-sectional area and the average velocity.

B. Method 2H

Method 2H, "Determination of Stack Gas Velocity Taking into Account Velocity Decay Near the Stack Wall", can be used in conjunction with existing Method 2 or new Methods 2F or 2G to account for velocity drop-off near stack (or duct) walls in circular stacks (or ducts) no less than 3.3 feet in diameter. Method 2H is not suitable for use in rectangular stacks or ducts because the procedures in this method are not applicable to the complex and varying flow dynamics characteristic of such configurations.

There are two main approaches for determining wall effects adjusted velocity in Method 2H. Either a default wall effects adjustment factor (WAF) (i.e., 0.9900 (for brick and mortar stacks), or 0.9950 (for all other stacks or ducts)) may be used with Method 2, 2F, or 2G without taking any wall effects measurements or a WAF may be calculated from velocity measurements taken at 16 or more Method 1 traverse points and at 8 or more wall effects points. EPA's Method 1, "Sample and Velocity Traverses for Stationary Sources", is the test method for determining the number and location of traverse points in a stack or duct. Method 1 alone is generally not suitable for determining wall effects.

During the course of wall effects field testing, several potential problems were uncovered. Procedures were incorporated into Method 2H to prevent these problems. These are described below.

(1) Locate Traverse Points

The field test revealed that care needs to be exercised when locating wall effects traverse points; otherwise, the full wall effect may not be measured. Thus, Method 2H instructs testers to take measurements at 1-inch intervals starting at 1 inch from the wall or at the next closest 1-inch interval from the wall possible. Testers may perform either a partial or complete wall effects traverse. For a partial traverse, measurements are taken at two wall effects traverse points per test port, at a minimum. For a complete traverse, a series of 1-inch incremented measurements are taken beginning no further than 4 inches from the wall and extending in 1-inch intervals as far as 12 inches from the wall. The method presents procedures for determining the location of the wall effects points.

(2) Determine Sampling Order

Field tests also showed that an incorrect WAF may be calculated if the wall effects sampling is decoupled from the Method 1 sampling. Therefore, the method includes instructions on how sampling is to be performed. The sampling order may be from the wall to the center or from the center to the wall. Although the Method 1 and wall effects points need not be interspersed at each port, there should be no interruption between sampling at the wall effects and Method 1 points. The intent of this sampling sequence is to keep the Method 1 and the wall effects measurements as close together in time as possible to reduce the possibility of different velocity conditions occurring during the Method 1 and wall effects measurements.

(3) Take and Record Measurements

As in Methods 2F and 2G, field tests showed that the procedures followed by testers were critical to the quality of the measurements obtained. Wall effects testing not only required the procedures found in Method 2F and 2G, but also additional procedures for taking measurements close to a stack or duct wall. For example, the method had to include instructions for testing in situations where it may not be possible to obtain measurements within a certain proximity (e.g., 1 inch) of the stack or duct wall. Method 2H instructs testers to perform the following steps. After inserting the probe into the gas stream, wait for the pressure and temperature readings to stabilize to stack or duct conditions before taking measurements at the first traverse point. (This time period is called the "system response time" and is defined in Methods 2F and 2G.) At all other traverse points, testers must allow enough time to obtain representative pressure measurements. If no velocity is detected at the wall effects point closest to the wall, move to the next 1-inch incremented wall effects point. Complete the integrated traverse as quickly as possible, consistent with adequate sampling time, so that the measurements are all taken under the same stack or duct conditions. In addition, take other measurements required by Method 2, 2F, or 2G (e.g., moisture, barometric pressure). Record all measurements.

(4) Perform Wall Effects Calculations

The field tests confirmed that a series of measurements near a stack wall could capture the impact of wall effects on flue gas flow in a stack or duct. To capture this effect, a new calculation procedure was developed which was tested in the field. This procedure was incorporated in Method 2H. It involves calculating the velocity at each wall effects traverse point and entering the resulting values in a table. The entered values are then used to find the wall effects-adjusted replacement velocities for the four Method 1 traverse points closest to the wall. These four values and the unadjusted velocity at the Method 1 traverse points are used to calculate a WAF. The WAF is a multiplier which can then be applied to the velocity derived using Methods 2, 2F, and 2G to account for velocity decay near the stack or duct wall. The WAF may be no less than 0.9800 for a partial traverse and no less than 0.9700 for a complete traverse. We derived these limits from analysis of wall effects tests performed on a variety of utility stacks (different stack lining material, velocities, and stack dimensions). If actual field testing indicates that the WAF for a particular stack or duct may be less than 0.970, the tester should increase the number of traverse points in the Method 1 traverse (e.g., to 20 or 24 points if a 16-point traverse was initially performed) and re-calculate the WAF to capture the full extent of the wall effect.

(5) Obtain Wall Effects Adjusted Velocity and Volumetric Flow Rate

While the field test showed the calculation procedures to be effective, the new test method also needed to clarify how WAFs were to be applied to calculate the wall effects adjusted volumetric flow rate for the stack or duct. Thus, the final steps in Method 2H include instructions on how to calculate the wall effects adjusted velocity for the stack or duct by multiplying the unadjusted velocity from Method 2, 2F, or 2G by the WAF (either calculated or default). The calculated WAF from one run may be applied to all runs of the same relative accuracy test audit (RATA). If calculated WAFs are obtained for several runs, the tester must average the WAFs and apply the resulting value to all runs of the same RATA. The stack or duct volumetric flow rate is then obtained by multiplying the wall effects adjusted velocity by the stack or duct cross-sectional area.

IV. Administrative Requirements

A. Executive Order 12866

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Administrator must determine whether the regulatory action is "significant" and therefore subject to Office of Management and Budget (OMB) review and the requirements of the Executive Order. The Order defines "significant regulatory action" as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

This action is not expected to have an annual effect on the economy of $100 million or more. Pursuant to the terms of Executive Order 12866, it has been determined that this direct final rule is not a significant action. As such, the direct final rule has not been submitted for OMB review.

Today's action provides options for applying scientific and analytical methods generally accepted by the scientific community. The options provided by this action are not precedential, but typical of the periodic improvements the Agency routinely makes to test methods based on advances in technology, science, and field experience. In keeping with past practice, we are retaining existing methods while offering new methods to provide the regulated community with additional choices and to lower the cost of compliance.

Since use of the new methods is voluntary, we anticipate that the new methods will be used only if they result in overall cost savings. While the cost of performing the new methods may be somewhat higher than the existing test method (due to higher probe calibration costs, increased stack testing time, and additional test equipment), these costs should be completely offset by compliance cost savings.

B. Executive Order 12875: Enhancing Intergovernmental Partnerships

Under Executive Order 12875, Enhancing Intergovernmental Partnerships, EPA may not issue a regulation that is not required by statute and that creates a mandate upon a State, local or tribal government, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by those governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 12875 requires EPA to provide to OMB a description of the extent of EPA's prior consultation with representatives of affected State, local and tribal governments, the nature of their concerns, copies of any written communications from the governments, and a statement supporting the need to issue the regulation. In addition, Executive Order 12875 requires EPA to develop an effective process permitting elected officials and other representatives of State, local and tribal governments "to provide meaningful and timely input in the development of regulatory proposals containing significant unfunded mandates."

As discussed above, today's direct final rule is voluntary and does not create a mandate on State, local or tribal governments. The rule does not impose any enforceable duties on these entities, unless they choose to use the new optional methods. Accordingly, the requirements of section 1(a) of Executive Order 12875 do not apply to this rule.

C. Executive Order 13084: Consultation and Coordination With Indian Tribal Governments

Under Executive Order 13084, Consultation and Coordination with Indian Tribal Governments, EPA may not issue a regulation that is not required by statute, that significantly or uniquely affects the communities of Indian tribal governments, and that imposes substantial direct compliance costs on those communities, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by the tribal governments, or EPA consults with those governments. If EPA complies by consulting, Executive Order 13084 requires EPA to provide to OMB, in a separately identified section of the preamble to the rule, a description of the extent of EPA's prior consultation with representatives of affected tribal governments, a summary of the nature of their concerns, and a statement supporting the need to issue the regulation. In addition, Executive Order 13084 requires EPA to develop an effective process permitting elected officials and other representatives of Indian tribal governments "to provide meaningful and timely input in the development of regulatory policies on matters that significantly or uniquely affect their communities."

Today's direct final rule does not significantly or uniquely affect the communities of Indian tribal governments. Today's action finalizes test method procedures for determining volumetric flow rate in stacks or ducts. Since use of the new methods is voluntary, we anticipate that the new methods will be used only if they result in overall cost savings. While the cost of performing the new methods may be somewhat higher than the existing test method (due to higher probe calibration costs, increased stack testing time, and additional test equipment), these costs should be completely offset either by compliance cost savings or increased compliance certainty. Accordingly, the requirements of section 3(b) of Executive Order 13084 do not apply to this rule.

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), P.L. 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with "Federal mandates" that may result in expenditures to State, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year. Before promulgating an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the final rule an explanation why that alternative was not adopted. Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

Today's direct final rule is not expected to result in expenditures of more than $100 million in any one year and, as such, is not subject to section 202 of the UMRA. The direct final rule is not expected to significantly or uniquely affect small governments.

E. Paperwork Reduction Act

Today's direct final rule will not add any additional information collection requirements to the current information collection requirements in the implementing regulations, e.g., part 75. Therefore an Information Collection Request was not prepared for the direct final rule.

An agency may not conduct or sponsor and a person is not required to respond to a collection of information, unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR part 9 and 48 CFR chapter 15.

F. Regulatory Flexibility

The Regulatory Flexibility Act, 5 U.S.C. 601, *et seq.*, generally requires an agency to conduct a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small not-for-profit enterprises, and governmental jurisdictions. EPA has determined that it is not necessary to prepare a regulatory flexibility analysis in connection with this direct final rule. EPA has also determined that this rule will not have a significant economic impact on a substantial number of small entities.

Since use of the new test methods is voluntary, we anticipate that the new options will be used only if they result in overall cost savings. While the cost of performing the new options may be somewhat higher than the existing test method (due to higher probe calibration costs, increased stack testing time, and additional test equipment), these costs should be completely offset by compliance cost savings.

G. Executive Order 13045

"Protection of Children From Environmental Health Risks and Safety Risks" (62 FR 19885, April 23, 1997) applies to any rule that: (1) Was initiated after April 21, 1997, or for which a Notice of Proposed Rulemaking was published after April 21, 1998; (2) is determined to be "economically significant" as defined under E.O. 12866, and (3) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets all three criteria, the Agency must evaluate the environmental health or safety effects of the planned rule on children and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

EPA interprets Executive Order 13045 as applying only to those regulatory actions that are based on health or safety risks, such that the analysis required under section 5–501 of the Executive Order has the potential to influence the regulation. This direct final rule is not subject to the Executive Order because the rule does not establish an environmental standard intended to mitigate health or safety risks.

H. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 ("NTTAA"), Pub L. 104–113 15 U.S.C. 272 note, directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, business practices) that are developed or adopted by voluntary consensus standards bodies. The NTTAA requires EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

EPA has not identified any voluntary consensus standards which might be applicable to this rulemaking.

I. Congressional Review Act

The Congressional Review Act, 5 U.S.C. 801 *et seq.*, as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the **Federal Register**. A major rule cannot take effect until 60 days after it is published in the **Federal Register**. This action is not a "major rule" as defined by 5 U.S.C. § 804(2). This rule will be effective on July 13, 1999.

List of Subjects in 40 CFR Part 60

Air pollution control, Carbon dioxide, Continuous emission monitors, Electric power plants, Environmental protection, Nitrogen oxides, Particulate matter, Reporting and recordkeeping requirements, Sulfur dioxide.

Dated: May 5, 1999.

Carol M. Browner,

Administrator.

For the reasons set out in the preamble, title 40 chapter 1 of the Code of Federal Regulations is amended as follows:

PART 60—[AMENDED]

1. The authority citation for part 60 continues to read as follows:

Authority: 42 U.S.C. 7401, 7411, 7413, 7414, 7416, 7429, 7601 and 7602.

2. Appendix A is amended in the introductory table of contents by adding in alphanumeric order Methods 2F, 2G and 2H and by adding Methods 2F, 2G and 2H to Appendix A to read as follows:

Appendix A to Part 60—Test Methods

* * * * *

"Method 2F—Determination of Stack Gas Velocity and Volumetric Flow Rate With Three-Dimensional Probes"

"Method 2G—Determination of Stack Gas Velocity and Volumetric Flow Rate With Two-Dimensional Probes"

"Method 2H—Determination of Stack Gas Velocity Taking Into Account Velocity Decay Near the Stack Wall"

* * * * *

Method 2F—Determination of Stack Gas Velocity And Volumetric Flow Rate With Three-Dimensional Probes

Note: This method does not include all of the specifications (e.g., equipment and supplies) and procedures (e.g., sampling) essential to its performance. Some material has been incorporated from other methods in this part. Therefore, to obtain reliable results, those using this method should have a thorough knowledge of at least the following additional test methods: Methods 1, 2, 3 or 3A, and 4.

1.0 Scope and Application

1.1 This method is applicable for the determination of yaw angle, pitch angle, axial velocity and the volumetric flow rate of a gas stream in a stack or duct using a three-dimensional (3-D) probe. This method may be used only when the average stack or duct gas velocity is greater than or equal to 20 ft/sec. When the above condition cannot be met, alternative procedures, approved by the Administrator, U.S. Environmental Protection Agency, shall be used to make accurate flow rate determinations.

2.0 Summary of Method

2.1 A 3-D probe is used to determine the velocity pressure and the yaw and pitch angles of the flow velocity vector in a stack or duct. The method determines the yaw angle directly by rotating the probe to null the pressure across a pair of symmetrically placed ports on the probe head. The pitch angle is calculated using probe-specific calibration curves. From these values and a determination of the stack gas density, the average axial velocity of the stack gas is calculated. The average gas volumetric flow rate in the stack or duct is then determined from the average axial velocity.

3.0 Definitions

3.1. *Angle-measuring Device Rotational Offset (R_{ADO}).* The rotational position of an angle-measuring device relative to the reference scribe line, as determined during the pre-test rotational position check described in section 8.3.

3.2 *Axial Velocity.* The velocity vector parallel to the axis of the stack or duct that accounts for the yaw and pitch angle components of gas flow. The term "axial" is used herein to indicate that the velocity and volumetric flow rate results account for the measured yaw and pitch components of flow at each measurement point.

3.3 *Calibration Pitot Tube.* The standard (Prandtl type) pitot tube used as a reference when calibrating a 3-D probe under this method.

3.4 *Field Test.* A set of measurements conducted at a specific unit or exhaust stack/duct to satisfy the applicable regulation (e.g., a three-run boiler performance test, a single- or multiple-load nine-run relative accuracy test).

3.5 *Full Scale of Pressure-measuring Device.* Full scale refers to the upper limit of the measurement range displayed by the device. For bi-directional pressure gauges, full scale includes the entire pressure range from the lowest negative value to the highest positive value on the pressure scale.

3.6 *Main probe.* Refers to the probe head and that section of probe sheath directly attached to the probe head. The main probe sheath is distinguished from probe extensions, which are sections of sheath added onto the main probe to extend its reach.

3.7 "*May,*" "*Must,*" "*Shall,*" "*Should,*" and the imperative form of verbs.

3.7.1 "*May*" is used to indicate that a provision of this method is optional.

3.7.2 "*Must,*" "*Shall,*" and the imperative form of verbs (such as "record" or "enter") are used to indicate that a provision of this method is mandatory.

3.7.3 "*Should*" is used to indicate that a provision of this method is not mandatory, but is highly recommended as good practice.

3.8 *Method 1.* Refers to 40 CFR part 60, appendix A, "Method 1—Sample and velocity traverses for stationary sources."

3.9 *Method 2.* Refers to 40 CFR part 60, appendix A, "Method 2—Determination of stack gas velocity and volumetric flow rate (Type S pitot tube)."

3.10 *Method 2G.* Refers to 40 CFR part 60, appendix A, "Method 2G—Determination of stack gas velocity and volumetric flow rate with two-dimensional probes."

3.11 *Nominal Velocity.* Refers to a wind tunnel velocity setting that approximates the actual wind tunnel velocity to within ±1.5 m/sec (±5 ft/sec).

3.12 *Pitch Angle.* The angle between the axis of the stack or duct and the pitch component of flow, i.e., the component of the total velocity vector in a plane defined by the traverse line and the axis of the stack or duct. (Figure 2F-1 illustrates the "pitch plane.") From the standpoint of a tester facing a test port in a vertical stack, the pitch component of flow is the vector of flow moving from the center of the stack toward or away from that test port. The pitch angle is the angle described by this pitch component of flow and the vertical axis of the stack.

3.13 *Readability.* For the purposes of this method, readability for an analog measurement device is one half of the smallest scale division. For a digital measurement device, it is the number of decimals displayed by the device.

3.14 *Reference Scribe Line.* A line permanently inscribed on the main probe sheath (in accordance with section 6.1.6.1) to serve as a reference mark for determining yaw angles.

3.15 *Reference Scribe Line Rotational Offset (R_{SLO}).* The rotational position of a probe's reference scribe line relative to the probe's yaw-null position, as determined during the yaw angle calibration described in section 10.5.

3.16 *Response Time.* The time required for the measurement system to fully respond to a change from zero differential pressure and ambient temperature to the stable stack or duct pressure and temperature readings at a traverse point.

3.17 *Tested Probe.* A 3-D probe that is being calibrated.

3.18 *Three-dimensional (3-D) Probe.* A directional probe used to determine the velocity pressure and yaw and pitch angles in a flowing gas stream.

3.19 *Traverse Line.* A diameter or axis extending across a stack or duct on which measurements of differential pressure and flow angles are made.

3.20 *Wind Tunnel Calibration Location.* A point, line, area, or volume within the wind tunnel test section at, along, or within which probes are calibrated. At a particular wind tunnel velocity setting, the average velocity pressures at specified points at, along, or within the calibration location shall vary by no more than 2 percent or 0.3 mm H_2O (0.01 in. H_2O), whichever is less restrictive, from the average velocity pressure at the calibration pitot tube location. Air flow at this location shall be axial, i.e., yaw and pitch angles within ±° of 0°. Compliance with these flow criteria shall be demonstrated by performing the procedures prescribed in sections 10.1.1 and 10.1.2. For circular tunnels, no part of the calibration location may be closer to the tunnel wall than 10.2 cm (4 in.) or 25 percent of the tunnel diameter, whichever is farther from the wall. For elliptical or rectangular tunnels, no part of the calibration location may be closer to the tunnel wall than 10.2 cm (4 in.) or 25 percent of the applicable cross-sectional axis, whichever is farther from the wall.

3.21 *Wind Tunnel with Documented Axial Flow.* A wind tunnel facility documented as meeting the provisions of sections 10.1.1 (velocity pressure cross-check) and 10.1.2 (axial flow verification) using the procedures described in these sections or alternative procedures determined to be technically equivalent.

3.22 *Yaw Angle.* The angle between the axis of the stack or duct and the yaw component of flow, i.e., the component of the total velocity vector in a plane perpendicular to the traverse line at a particular traverse point. (Figure 2F-1 illustrates the "yaw plane.") From the standpoint of a tester facing a test port in a vertical stack, the yaw component of flow is the vector of flow moving to the left or right from the center of the stack as viewed by the tester. (This is sometimes referred to as "vortex flow," i.e., flow around the centerline of a stack or duct.) The yaw angle is the angle described by this yaw component of flow and the vertical axis of the stack. The algebraic sign convention is illustrated in Figure 2F-2.

3.23 *Yaw Nulling.* A procedure in which a probe is rotated about its axis in a stack or duct until a zero differential pressure reading ("yaw null") is obtained. When a 3-D probe is yaw-nulled, its impact pressure port (P_1) faces directly into the direction of flow in the stack or duct and the differential pressure between pressure ports P_2 and P_3 is zero.

4.0 *Interferences.* [Reserved]

5.0 *Safety.*

5.1 This test method may involve hazardous operations and the use of hazardous materials or equipment. This method does not purport to address all of the safety problems associated with its use. It is the responsibility of the user to establish and implement appropriate safety and health practices and to determine the applicability of regulatory limitations before using this test method.

6.0 Equipment and Supplies

6.1 Three-dimensional Probes. The 3-D probes as specified in subsections 6.1.1 through 6.1.3 below qualify for use based on comprehensive wind tunnel and field studies involving both inter-and intra-probe comparisons by multiple test teams. Other types of probes shall not be used unless approved by the Administrator. Each 3-D probe shall have a unique identification number or code permanently marked on the main probe sheath. The minimum recommended diameter of the sensing head of any probe used under this method is 2.5 cm (1 in.). Each probe shall be calibrated prior to use according to the procedures in section 10. Manufacturer-supplied calibration data shall be used as example information only, except when the manufacturer calibrates the 3-D probe as specified in section 10 and provides complete documentation.

6.1.1 Five-hole prism-shaped probe. This type of probe consists of five pressure taps in the flat facets of a prism-shaped sensing head. The pressure taps are numbered 1 through 5, with the pressures measured at each hole referred to as P_1, P_2, P_3, P_4, and P_5, respectively. Figure 2F-3 is an illustration of the placement of pressure taps on a commonly available five-hole prism-shaped probe, the 2.5-cm (1-in.) DAT probe. (Note: Mention of trade names or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) The numbering arrangement for the prism-shaped sensing head presented in Figure 2F-3 shall be followed for correct operation of the probe. A brief description of the probe measurements involved is as follows: the differential pressure P_2–P_3 is used to yaw null the probe and determine the yaw angle; the differential pressure P_4–P_5 is a function of pitch angle; and the differential pressure P_1–P_2 is a function of total velocity.

6.1.2 Five-hole spherical probe. This type of probe consists of five pressure taps in a spherical sensing head. As with the prism-shaped probe, the pressure taps are numbered 1 through 5, with the pressures measured at each hole referred to as P_1, P_2, P_3, P_4, and P_5, respectively. However, the P_4 and P_5 pressure taps are in the reverse location from their respective positions on the prism-shaped probe head. The differential pressure P_2–P_3 is used to yaw null the probe and determine the yaw angle; the differential pressure P_4–P_5 is a function of pitch angle; and the differential pressure P_1–P_2 is a function of total velocity. A diagram of a typical spherical probe sensing head is presented in Figure 2F-4. Typical probe dimensions are indicated in the illustration.

6.1.3 A manual 3-D probe refers to a five-hole prism-shaped or spherical probe that is positioned at individual traverse points and yaw nulled manually by an operator. An automated 3-D probe refers to a system that uses a computer-controlled motorized mechanism to position the five-hole prism-shaped or spherical head at individual traverse points and perform yaw angle determinations.

6.1.4 Other three-dimensional probes. [Reserved]

6.1.5 Probe sheath. The probe shaft shall include an outer sheath to: (1) provide a surface for inscribing a permanent reference scribe line, (2) accommodate attachment of an angle-measuring device to the probe shaft, and (3) facilitate precise rotational movement of the probe for determining yaw angles. The sheath shall be rigidly attached to the probe assembly and shall enclose all pressure lines from the probe head to the farthest position away from the probe head where an angle-measuring device may be attached during use in the field. The sheath of the fully assembled probe shall be sufficiently rigid and straight at all rotational positions such that, when one end of the probe shaft is held in a horizontal position, the fully extended probe meets the horizontal straightness specifications indicated in section 8.2 below.

6.1.6 Scribe lines.

6.1.6.1 Reference scribe line. A permanent line, no greater than 1.6 mm (1/16 in.) in width, shall be inscribed on each manual probe that will be used to determine yaw angles of flow. This line shall be placed on the main probe sheath in accordance with the procedures described in section 10.4 and is used as a reference position for installation of the yaw angle-measuring device on the probe. At the discretion of the tester, the scribe line may be a single line segment placed at a particular position on the probe sheath (e.g., near the probe head), multiple line segments placed at various locations along the length of the probe sheath (e.g., at every position where a yaw angle-measuring device may be mounted), or a single continuous line extending along the full length of the probe sheath.

6.1.6.2 Scribe line on probe extensions. A permanent line may also be inscribed on any probe extension that will be attached to the main probe in performing field testing. This allows a yaw angle-measuring device mounted on the extension to be readily aligned with the reference scribe line on the main probe sheath.

6.1.6.3 Alignment specifications. This specification shall be met separately, using the procedures in section 10.4.1, on the main probe and on each probe extension. The rotational position of the scribe line or scribe line segments on the main probe or any probe extension must not vary by more than 2°. That is, the difference between the minimum and maximum of all of the rotational angles that are measured along the full length of the main probe or the probe extension must not exceed 2°.

6.1.7 Probe and system characteristics to ensure horizontal stability.

6.1.7.1 For manual probes, it is recommended that the effective length of the probe (coupled with a probe extension, if necessary) be at least 0.9 m (3 ft.) longer than the farthest traverse point mark on the probe shaft away from the probe head. The operator should maintain the probe's horizontal stability when it is fully inserted into the stack or duct. If a shorter probe is used, the probe should be inserted through a bushing sleeve, similar to the one shown in Figure 2F-5, that is installed on the test port; such a bushing shall fit snugly around the probe and be secured to the stack or duct entry port in such a manner as to maintain the probe's horizontal stability when fully inserted into the stack or duct.

6.1.7.2 An automated system that includes an external probe casing with a transport system shall have a mechanism for maintaining horizontal stability comparable to that obtained by manual probes following the provisions of this method. The automated probe assembly shall also be constructed to maintain the alignment and position of the pressure ports during sampling at each traverse point. The design of the probe casing and transport system shall allow the probe to be removed from the stack or duct and checked through direct physical measurement for angular position and insertion depth.

6.1.8 The tubing that is used to connect the probe and the pressure-measuring device should have an inside diameter of at least 3.2 mm (1/8 in.), to reduce the time required for pressure equilibration, and should be as short as practicable.

6.2 Yaw Angle-measuring Device. One of the following devices shall be used for measurement of the yaw angle of flow.

6.2.1 Digital inclinometer. This refers to a digital device capable of measuring and displaying the rotational position of the probe to within ±1°. The device shall be able to be locked into position on the probe sheath or probe extension, so that it indicates the probe's rotational position throughout the test. A rotational position collar block that can be attached to the probe sheath (similar to the collar shown in Figure 2F-6) may be required to lock the digital inclinometer into position on the probe sheath.

6.2.2 Protractor wheel and pointer assembly. This apparatus, similar to that shown in Figure 2F-7, consists of the following components.

6.2.2.1 A protractor wheel that can be attached to a port opening and set in a fixed rotational position to indicate the yaw angle position of the probe's scribe line relative to the longitudinal axis of the stack or duct. The protractor wheel must have a measurement ring on its face that is no less than 17.8 cm (7 in.) in diameter, shall be able to be rotated to any angle and then locked into position on the stack or duct port, and shall indicate angles to a resolution of 1°.

6.2.2.2 A pointer assembly that includes an indicator needle mounted on a collar that can slide over the probe sheath and be locked into a fixed rotational position on the probe sheath. The pointer needle shall be of sufficient length, rigidity, and sharpness to allow the tester to determine the probe's angular position to within 1° from the markings on the protractor wheel. Corresponding to the position of the pointer, the collar must have a scribe line to be used in aligning the pointer with the scribe line on the probe sheath.

6.2.3 Other yaw angle-measuring devices. Other angle-measuring devices with a manufacturer's specified precision of 1° or better may be used, if approved by the Administrator.

6.3 Probe Supports and Stabilization Devices. When probes are used for determining flow angles, the probe head should be kept in a stable horizontal position. For probes longer than 3.0 m (10 ft.), the section of the probe that extends outside the test port shall be secured. Three alternative devices are suggested for maintaining the horizontal position and stability of the probe shaft during flow angle determinations and velocity pressure measurements: (1) Monorails installed above each port, (2) probe stands on which the probe shaft may be rested, or (3) bushing sleeves of sufficient length secured to the test ports to maintain probes in a horizontal position. Comparable provisions shall be made to ensure that automated systems maintain the horizontal position of the probe in the stack or duct. The physical characteristics of each test platform may dictate the most suitable type of stabilization device. Thus, the choice of a specific stabilization device is left to the judgment of the testers.

6.4 Differential Pressure Gauges. The pressure (ΔP) measuring devices used during wind tunnel calibrations and field testing shall be either electronic manometers (e.g., pressure transducers), fluid manometers, or mechanical pressure gauges (e.g., Magnehelic® gauges). Use of electronic manometers is recommended. Under low velocity conditions, use of electronic manometers may be necessary to obtain acceptable measurements.

6.4.1 Differential pressure-measuring device. This refers to a device capable of measuring pressure differentials and having a readability of ±1 percent of full scale. The device shall be capable of accurately measuring the maximum expected pressure differential. Such devices are used to determine the following pressure measurements: velocity pressure, static pressure, yaw-null pressure, and pitch-angle pressure. For an inclined-vertical manometer, the readability specification of ±1 percent shall be met separately using the respective full-scale upper limits of the inclined and vertical portions of the scales. To the extent practicable, the device shall be selected such that most of the pressure readings are between 10 and 90 percent of the device's full-scale measurement range (as defined in section 3.5). Typical velocity pressure (P_1–P_2) ranges for both the prism-shaped probe and the spherical probe are 0 to 1.3 cm H_2O (0 to 0.5 in. H_2O), 0 to 5.1 cm H_2O (0 to 2 in. H_2O), and 0 to 12.7 cm H_2O (0 to 5 in. H_2O). The pitch angle (P_4–P_5) pressure range is typically −6.4 to +6.4 mm H_2O (−0.25 to +0.25 in. H_2O) or −12.7 to +12.7 mm H_2O (−0.5 to +0.5 in. H_2O) for the prism-shaped probe, and −12.7 to +12.7 mm H_2O (−0.5 to +0.5 in. H_2O) or −5.1 to +5.1 cm H_2O (−2 to +2 in. H_2O) for the spherical probe. The pressure range for the yaw null (P_2–P_3) readings is typically −12.7 to +12.7 mm H_2O (−0.5 to +0.5 in. H_2O) for both probe types. In addition, pressure-measuring devices should be selected such that the zero does not drift by more than 5 percent of the average expected pressure readings to be encountered during the field test. This is particularly important under low pressure conditions.

6.4.2 Gauge used for yaw nulling. The differential pressure-measuring device chosen for yaw nulling the probe during the wind tunnel calibrations and field testing shall be bi-directional, i.e., capable of reading both positive and negative differential pressures. If a mechanical, bi-directional pressure gauge is chosen, it shall have a full-scale range no greater than 2.6 cm H_2O (1 in. H_2O) [i.e., −1.3 to +1.3 cm H_2O (−0.5 in. to +0.5 in.)].

6.4.3 Devices for calibrating differential pressure-measuring devices. A precision manometer (e.g., a U-tube, inclined, or inclined-vertical manometer, or micromanometer) or NIST (National Institute of Standards and Technology) traceable pressure source shall be used for calibrating differential pressure-measuring devices. The device shall be maintained under laboratory conditions or in a similar protected environment (e.g., a climate-controlled trailer). It shall not be used in field tests. The precision manometer shall have a scale gradation of 0.3 mm H_2O (0.01 in. H_2O), or less, in the range of 0 to 5.1 cm H_2O (0 to 2 in. H_2O) and 2.5 mm H_2O (0.1 in. H_2O), or less, in the range of 5.1 to 25.4 cm H_2O (2 to 10 in. H_2O). The manometer shall have manufacturer's documentation that it meets an accuracy specification of at least 0.5 percent of full scale. The NIST-traceable pressure source shall be recertified annually.

6.4.4 Devices used for post-test calibration check. A precision manometer meeting the specifications in section 6.4.3, a pressure-measuring device or pressure source with a documented calibration traceable to NIST, or an equivalent device approved by the Administrator shall be used for the post-test calibration check. The pressure-measuring device shall have a readability equivalent to or greater than the tested device. The pressure source shall be capable of generating pressures between 50 and 90 percent of the range of the tested device and known to within ±1 percent of the full scale of the tested device. The pressure source shall be recertified annually.

6.5 Data Display and Capture Devices. Electronic manometers (if used) shall be coupled with a data display device (such as a digital panel meter, personal computer display, or strip chart) that allows the tester to observe and validate the pressure measurements taken during testing. They shall also be connected to a data recorder (such as a data logger or a personal computer with data capture software) that has the ability to compute and retain the appropriate average value at each traverse point, identified by collection time and traverse point.

6.6 Temperature Gauges. For field tests, a thermocouple or resistance temperature detector (RTD) capable of measuring temperature to within ±3°C (±5°F) of the stack or duct temperature shall be used. The thermocouple shall be attached to the probe such that the sensor tip does not touch any metal and is located on the opposite side of the probe head from the pressure ports so as not to interfere with the gas flow around the probe head. The position of the thermocouple relative to the pressure port face openings shall be in the same configuration as used for the probe calibrations in the wind tunnel. Temperature gauges used for wind tunnel calibrations shall be capable of measuring temperature to within ±0.6°C (±1°F) of the temperature of the flowing gas stream in the wind tunnel.

6.7 Stack or Duct Static Pressure Measurement. The pressure-measuring device used with the probe shall be as specified in section 6.4 of this method. The static tap of a standard (Prandtl type) pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may be used for this measurement. Also acceptable is the pressure differential reading of P_1-P_{bar} from a five-hole prism-shaped probe (e.g., Type DA or DAT probe) with the P_1 pressure port face opening positioned parallel to the gas flow in the same manner as the Type S probe. However, the spherical probe, as specified in section 6.1.2, is unable to provide this measurement and shall not be used to take static pressure measurements. Static pressure measurement is further described in section 8.11.

6.8 Barometer. Same as Method 2, section 2.5.

6.9 Gas Density Determination Equipment. Method 3 or 3A shall be used to determine the dry molecular weight of the stack gas. Method 4 shall be used for moisture content determination and computation of stack gas wet molecular weight. Other methods may be used, if approved by the Administrator.

6.10 Calibration Pitot Tube. Same as Method 2, section 2.7.

6.11 Wind Tunnel for Probe Calibration. Wind tunnels used to calibrate velocity probes must meet the following design specifications.

6.11.1 Test section cross-sectional area. The flowing gas stream shall be confined within a circular, rectangular, or elliptical duct. The cross-sectional area of the tunnel must be large enough to ensure fully developed flow in the presence of both the calibration pitot tube and the tested probe. The calibration site, or "test section," of the wind tunnel shall have a minimum diameter of 30.5 cm (12 in.) for circular or elliptical duct cross-sections or a minimum width of 30.5 cm (12 in.) on the shorter side for rectangular cross-sections. Wind tunnels shall meet the probe blockage provisions of this section and the qualification requirements prescribed in section 10.1. The projected area of the portion of the probe head, shaft, and attached devices inside the wind tunnel during calibration shall represent no more than 4 percent of the cross-sectional area of the tunnel. The projected area shall include the combined area of the calibration pitot tube and the tested probe if both probes are placed simultaneously in the same cross-sectional plane in the wind tunnel, or the larger projected area of the two probes if they are placed alternately in the wind tunnel.

6.11.2 Velocity range and stability. The wind tunnel should be capable of maintaining velocities between 6.1 m/sec and 30.5 m/sec (20 ft/sec and 100 ft/sec). The wind tunnel shall produce fully developed flow patterns that are stable and parallel to the axis of the duct in the test section.

6.11.3 Flow profile at the calibration location. The wind tunnel shall provide axial flow within the test section calibration location (as defined in section 3.20). Yaw and pitch angles in the calibration location shall be within ±3° of 0°. The procedure for determining that this requirement has been met is described in section 10.1.2.

6.11.4 Entry ports in the wind tunnel test section.

6.11.4.1 Port for tested probe. A port shall be constructed for the tested probe. The port should have an elongated slot parallel to the axis of the duct at the test section. The elongated slot should be of sufficient length to allow attaining all the pitch angles at which the probe will be calibrated for use in the field. To facilitate alignment of the probe during calibration, the test section should include a window constructed of a transparent material to allow the tested probe to be viewed. This port shall be located to allow the head of the tested probe to be positioned within the calibration location (as defined in section 3.20) at all pitch angle settings.

6.11.4.2 Port for verification of axial flow. Depending on the equipment selected to conduct the axial flow verification prescribed in section 10.1.2, a second port, located 90° from the entry port for the tested probe, may be needed to allow verification that the gas flow is parallel to the central axis of the test section. This port should be located and constructed so as to allow one of the probes described in section 10.1.2.2 to access the same test point(s) that are accessible from the port described in section 6.11.4.1.

6.11.4.3 Port for calibration pitot tube. The calibration pitot tube shall be used in the port for the tested probe or a separate entry port. In either case, all measurements with the calibration pitot tube shall be made at the same point within the wind tunnel over the course of a probe calibration. The measurement point for the calibration pitot tube shall meet the same specifications for distance from the wall and for axial flow as described in section 3.20 for the wind tunnel calibration location

6.11.5 Pitch angle protractor plate. A protractor plate shall be attached directly under the port used with the tested probe and set in a fixed position to indicate the pitch angle position of the probe relative to the longitudinal axis of the wind tunnel duct (similar to Figure 2F–8). The protractor plate shall indicate angles in 5° increments with a minimum resolution of ±2°. The tested probe shall be able to be locked into position at the desired pitch angle delineated on the protractor. The probe head position shall be maintained within the calibration location (as defined in section 3.20) in the test section of the wind tunnel during all tests across the range of pitch angles.

7.0 Reagents and Standards. [Reserved]

8.0 Sample Collection and Analysis

8.1 Equipment Inspection and Set-Up

8.1.1 All probes, differential pressure-measuring devices, yaw angle-measuring devices, thermocouples, and barometers shall have a current, valid calibration before being used in a field test. (See sections 10.3.3, 10.3.4, and 10.5 through10.10 for the applicable calibration requirements.)

8.1.2 Before each field use of a 3-D probe, perform a visual inspection to verify the physical condition of the probe head according to the procedures in section 10.2. Record the inspection results on a form similar to Table 2F–1. If there is visible damage to the 3-D probe, the probe shall not be used until it is recalibrated.

8.1.3 After verifying that the physical condition of the probe head is acceptable, set up the apparatus using lengths of flexible tubing that are as short as practicable. Surge tanks installed between the probe and pressure-measuring device may be used to dampen pressure fluctuations provided that an adequate measurement response time (see section 8.8) is maintained.

8.2 Horizontal Straightness Check. A horizontal straightness check shall be performed before the start of each field test, except as otherwise specified in this section. Secure the fully assembled probe (including the probe head and all probe shaft extensions) in a horizontal position using a stationary support at a point along the probe shaft approximating the location of the stack or duct entry port when the probe is sampling at the farthest traverse point from the stack or duct wall. The probe shall be rotated to detect bends. Use an angle-measuring device or trigonometry to determine the bend or sag between the probe head and the secured end. (See Figure 2F–9.) Probes that are bent or sag by more than 5° shall not be used. Although this check does not apply when the probe is used for a vertical traverse, care should be taken to avoid the use of bent probes when conducting vertical traverses. If the probe is constructed of a rigid steel material and consists of a main probe without probe extensions, this check need only be performed before the initial field use of the probe, when the probe is recalibrated, when a change is made to the the design or material of the probe assembly, and when the probe becomes bent. With such probes, a visual inspection shall be made of the fully assembled probe before each field test to determine if a bend is visible. The probe shall be rotated to detect bends. The inspection results shall be documented in the field test report. If a bend in the probe is visible, the horizontal straightness check shall be performed before the probe is used.

8.3 Rotational Position Check. Before each field test, and each time an extension is added to the probe during a field test, a rotational position check shall be performed on all manually operated probes (except as noted in section 8.3.5, below) to ensure that, throughout testing, the angle-measuring device is either: aligned to within ±1° of the rotational position of the reference scribe line; or is affixed to the probe such that the rotational offset of the device from the reference scribe line is known to within ±1°. This check shall consist of direct measurements of the rotational positions of the reference scribe line and angle-measuring device sufficient to verify that these specifications are met. Annex A in section 18 of this method gives recommended procedures for performing the rotational position check, and Table 2F–2 gives an example data form. Procedures other than those recommended in Annex A in section 18 may be used, provided they demonstrate whether the alignment specification is met and are explained in detail in the field test report.

8.3.1 Angle-measuring device rotational offset. The tester shall maintain a record of the angle-measuring device rotational offset, R_{ADO}, as defined in section 3.1. Note that R_{ADO} is assigned a value of 0° when the angle-measuring device is aligned to within ±1° of the rotational position of the reference scribe line. The R_{ADO} shall be used to determine the yaw angle of flow in accordance with section 8.9.4.

8.3.2 Sign of angle-measuring device rotational offset. The sign of R_{ADO} is positive when the angle-measuring device (as viewed from the "tail" end of the probe) is positioned in a clockwise direction from the reference scribe line and negative when the device is positioned in a counterclockwise direction from the reference scribe line.

8.3.3 Angle-measuring devices that can be independently adjusted (e.g., by means of a set screw), after being locked into position on the probe sheath, may be used. However, the R_{ADO} must also take into account this adjustment.

8.3.4 Post-test check. If probe extensions remain attached to the main probe throughout the field test, the rotational position check shall be repeated, at a minimum, at the completion of the field test to ensure that the angle-measuring device has remained within ±2° of its rotational position established prior to testing. At the discretion of the tester, additional checks may be conducted after completion of testing at any sample port or after any test run. If the ±2° specification is not met, all measurements made since the last successful rotational position check must be repeated. Section 18.1.1.3 of Annex A provides an example procedure for performing the post-test check.

8.3.5 Exceptions.

8.3.5.1 A rotational position check need not be performed if, for measurements taken at all velocity traverse points, the yaw angle-measuring device is mounted and aligned directly on the reference scribe line specified in sections 6.1.6.1 and 6.1.6.3 and no independent adjustments, as described in section 8.3.3, are made to the device's rotational position.

8.3.5.2 If extensions are detached and re-attached to the probe during a field test, a rotational position check need only be performed the first time an extension is added to the probe, rather than each time the extension is re-attached, if the probe extension is designed to be locked into a mechanically fixed rotational position (e.g., through use of interlocking grooves) that can re-establish the initial rotational position to within ±1°.

8.4 Leak Checks. A pre-test leak check shall be conducted before each field test. A post-test check shall be performed at the end of the field test, but additional leak checks may be conducted after any test run or group of test runs. The post-test check may also serve as the pre-test check for the next group of test runs. If any leak check is failed, all runs since the last passed leak check are invalid. While performing the leak check procedures, also check each pressure device's responsiveness to the changes in pressure.

8.4.1 To perform the leak check, pressurize the probe's P_1 pressure port until at least 7.6 cm H_2O (3 in. H_2O) pressure, or a pressure corresponding to approximately 75 percent of the pressure-measuring device's measurement scale, whichever is less, registers on the device; then, close off the pressure port. The pressure shall remain stable [±2.5 mm H_2O (±0.10 in. H_2O)] for at least 15 seconds. Check the P_2, P_3, P_4, and P_5 pressure ports in the same fashion. Other leak-check procedures may be used, if approved by the Administrator.

8.5 Zeroing the Differential Pressure-measuring Device. Zero each differential pressure-measuring device, including the device used for yaw nulling, before each field test. At a minimum, check the zero after each field test. A zero check may also be performed after any test run or group of test runs. For fluid manometers and mechanical pressure gauges (e.g., Magnehelic® gauges), the zero reading shall not deviate from zero by more than ±0.8 mm H_2O (±0.03 in. H_2O) or one minor scale division, whichever is greater, between checks. For electronic manometers, the zero reading shall not deviate from zero between checks by more than: ±0.3 mm H_2O (±0.01 in. H_2O), for full scales less than or equal to 5.1 cm H_2O (2.0 in. H_2O); or ±0.8 mm H_2O (±0.03 in. H_2O), for full scales greater than 5.1 cm H_2O (2.0 in. H_2O). (Note: If negative zero drift is not directly readable, estimate the reading based on the position of the gauge oil in the manometer or of the needle on the pressure gauge.) In addition, for all pressure-measuring devices except those used exclusively for yaw nulling, the zero reading shall not deviate from zero by more than 5 percent of the average measured differential pressure at any distinct process condition or load level. If any zero check is failed at a specific process condition or load level, all runs conducted at that process condition or load level since the last passed zero check are invalid.

8.6 Traverse Point Verification. The number and location of the traverse points shall be selected based on Method 1 guidelines. The stack or duct diameter and port nipple lengths, including any extension of the port nipples into stack or duct, shall be verified the first time the test is performed; retain and use this information for subsequent field tests, updating it as required. Physically measure the stack or duct dimensions or use a calibrated laser device; do not use engineering drawings of the stack or duct. The probe length necessary to reach each traverse point shall be recorded to within ±6.4 mm (±1/4 in.) and, for manual probes, marked on the probe sheath. In determining these lengths, the tester shall take into account both the distance that the port flange projects outside of the stack and the depth that any port nipple extends into the gas stream. The resulting point positions shall reflect the true distances from the inside wall of the stack or duct, so that when the tester aligns any of the markings with the outside face of the stack port, the probe's impact port shall be located at the appropriate distance from the inside wall for the respective Method 1 traverse point. Before beginning testing at a particular location, an out-of-stack or duct verification shall be performed on each probe that will be used to ensure that these position markings are correct. The distances measured during the verification must agree with the previously calculated distances to within ±1/4 in. For manual probes, the traverse point positions shall be verified by measuring the distance of each mark from the probe's P_1 pressure port. A comparable out-of-stack test shall be performed on automated probe systems. The probe shall be extended to each of the prescribed traverse point positions. Then, the accuracy of the positioning for each traverse point shall be verified by measuring the distance between the port flange and the probe's P_1 pressure port.

8.7 Probe Installation. Insert the probe into the test port. A solid material shall be used to seal the port.

8.8 System Response Time. Determine the response time of the probe measurement system. Insert and position the "cold" probe (at ambient temperature and pressure) at any Method 1 traverse point. Read and record the probe's P_1–P_2 differential pressure, temperature, and elapsed time at 15-second intervals until stable readings for both pressure and temperature are achieved. The response time is the longer of these two elapsed times. Record the response time.

8.9 Sampling.

8.9.1 Yaw angle measurement protocol. With manual probes, yaw angle measurements may be obtained in two alternative ways during the field test, either by using a yaw angle-measuring device (e.g., digital inclinometer) affixed to the probe, or using a protractor wheel and pointer assembly. For horizontal traversing, either approach may be used. For vertical traversing, i.e., when measuring from on top or into the bottom of a horizontal duct, only the protractor wheel and pointer assembly may be used. With automated probes, curve-fitting protocols may be used to obtain yaw-angle measurements.

8.9.1.1 If a yaw angle-measuring device affixed to the probe is to be used, lock the device on the probe sheath, aligning it either on the reference scribe line or in the rotational offset position established under section 8.3.1.

8.9.1.2 If a protractor wheel and pointer assembly is to be used, follow the procedures in Annex B of this method.

8.9.1.3 Other yaw angle-determination procedures. If approved by the Administrator, other procedures for determining yaw angle may be used, provided that they are verified in a wind tunnel to be able to perform the yaw angle calibration procedure as described in section 10.5.

8.9.2 Sampling strategy. At each traverse point, first yaw-null the probe, as described in section 8.9.3, below. Then, with the probe oriented into the direction of flow, measure and record the yaw angle, the differential pressures and the temperature at the traverse point, after stable readings are achieved, in accordance with sections 8.9.4 and 8.9.5. At the start of testing in each port (i.e., after a probe has been inserted into the flue gas stream), allow at least the response time to elapse before beginning to take measurements at the first traverse point accessed from that port. Provided that the probe is not removed from the flue gas stream, measurements may be taken at subsequent traverse points accessed from the same test port without waiting again for the response time to elapse.

8.9.3 Yaw-nulling procedure. In preparation for yaw angle determination, the probe must first be yaw nulled. After positioning the probe at the appropriate traverse point, perform the following procedures.

8.9.3.1 Rotate the probe until a null differential pressure reading (the difference in pressures across the P_2 and P_3 pressure ports is zero, i.e., $P_2 = P_3$) is indicated by the yaw angle pressure gauge. Read and record the angle displayed by the angle-measuring device.

8.9.3.2 Sign of the measured angle. The angle displayed on the angle-measuring device is considered positive when the probe's impact pressure port (as viewed from the "tail" end of the probe) is oriented in a clockwise rotational position relative to the stack or duct axis and is considered negative when the probe's impact pressure port is oriented in a counterclockwise rotational position (see Figure 2F–10).

8.9.4 Yaw angle determination. After performing the yaw-nulling procedure in section 8.9.3, determine the yaw angle of flow according to one of the following procedures. Special care must be observed to take into account the signs of the recorded angle and all offsets.

8.9.4.1 Direct-reading. If all rotational offsets are zero or if the angle-measuring device rotational offset (R_{ADO}) determined in section 8.3 exactly compensates for the scribe line rotational offset (R_{SLO}) determined in section 10.5, then the magnitude of the yaw angle is equal to the displayed angle-measuring device reading from section 8.9.3.1. The algebraic sign of the yaw angle is determined in accordance with section 8.9.3.2.

Note: Under certain circumstances (e.g., testing of horizontal ducts), a 90° adjustment to the angle-measuring device readings may be necessary to obtain the correct yaw angles.

8.9.4.2 Compensation for rotational offsets during data reduction. When the angle-measuring device rotational offset does not compensate for reference scribe line rotational offset, the following procedure shall be used to determine the yaw angle:

(a) Enter the reading indicated by the angle-measuring device from section 8.9.3.1.

(b) Associate the proper algebraic sign from section 8.9.3.2 with the reading in step (a).

(c) Subtract the reference scribe line rotational offset, R_{SLO}, from the reading in step (b).

(d) Subtract the angle-measuring device rotational offset, R_{ADO}, if any, from the result obtained in step (c).

(e) The final result obtained in step (d) is the yaw angle of flow.

Note: It may be necessary to first apply a 90° adjustment to the reading in step (a), in order to obtain the correct yaw angle.

8.9.4.3 Record the yaw angle measurements on a form similar to Table 2F–3.

8.9.5 Velocity determination. Maintain the probe rotational position established during the yaw angle determination. Then, begin recording the pressure-measuring device readings for the impact pressure (P_1–P_2) and pitch angle pressure (P_4–P_5). These pressure measurements shall be taken over a sampling period of sufficiently long duration to ensure representative readings at each traverse point. If the pressure measurements are determined from visual readings of the pressure device or display, allow sufficient time to observe the pulsation in the readings to obtain a sight-weighted average, which is then recorded manually. If an automated data acquisition system (e.g., data logger, computer-based data recorder, strip chart recorder) is used to record the pressure measurements, obtain an integrated average of all pressure readings at the traverse point. Stack or duct gas temperature measurements shall be recorded, at a minimum, once at each traverse point. Record all necessary data as shown in the example field data form (Table 2F–3).

8.9.6 Alignment check. For manually operated probes, after the required yaw angle and differential pressure and temperature measurements have been made at each traverse point, verify (e.g., by visual inspection) that the yaw angle-measuring device has remained in proper alignment with the reference scribe line or with the rotational offset position established in section 8.3. If, for a particular traverse point, the angle-measuring device is found to be in proper alignment, proceed to the next traverse point; otherwise, re-align the device and repeat the angle and differential pressure measurements at the traverse point. In the course of a traverse, if a mark used to properly align the angle-measuring device (e.g., as described in section 18.1.1.1) cannot be located, re-establish the alignment mark before proceeding with the traverse.

8.10 Probe Plugging. Periodically check for plugging of the pressure ports by observing the responses on pressure differential readouts. Plugging causes erratic results or sluggish responses. Rotate the probe to determine whether the readouts respond in the expected direction. If plugging is detected, correct the problem and repeat the affected measurements.

8.11 Static Pressure. Measure the static pressure in the stack or duct using the equipment described in section 6.7.

8.11.1 If a Type DA or DAT probe is used for this measurement, position the probe at or between any traverse point(s) and rotate the probe until a null differential pressure reading is obtained at P_2–P_3. Rotate the probe 90°. Disconnect the P_2 pressure side of the probe and read the pressure P_1-P_{bar} and record as the static pressure. (Note: The spherical probe, specified in section 6.1.2, is unable to provide this measurement and shall not be used to take static pressure measurements.)

8.11.2 If a Type S probe is used for this measurement, position the probe at or between any traverse point(s) and rotate the probe until a null differential pressure reading is obtained. Disconnect the tubing from one of the pressure ports; read and record the ΔP. For pressure devices with one-directional scales, if a deflection in the positive direction is noted with the negative side disconnected, then the static pressure is positive. Likewise, if a deflection in the positive direction is noted with the positive side disconnected, then the static pressure is negative.

8.12 Atmospheric Pressure. Determine the atmospheric pressure at the sampling elevation during each test run following the procedure described in section 2.5 of Method 2.

8.13 Molecular Weight. Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO, and N_2, use Method 3 or 3A. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. Other methods may be used, if approved by the Administrator.

8.14 Moisture. Determine the moisture content of the stack gas using Method 4 or equivalent.

8.15 Data Recording and Calculations. Record all required data on a form similar to Table 2F–3.

8.15.1 Selection of appropriate calibration curves. Choose the appropriate pair of F_1 and F_2 versus pitch angle calibration curves, created as described in section 10.6.

8.15.2 Pitch angle derivation. Use the appropriate calculation procedures in section 12.2 to find the pitch angle ratios that are applicable at each traverse point. Then, find the pitch angles corresponding to these pitch angle ratios on the "F_1 versus pitch angle" curve for the probe.

8.15.3 Velocity calibration coefficient derivation. Use the pitch angle obtained following the procedures described in section 8.15.2 to find the corresponding velocity calibration coefficients from the "F_2 versus pitch angle" calibration curve for the probe.

8.15.4 Calculations. Calculate the axial velocity at each traverse point using the equations presented in section 12.2 to account for the yaw and pitch angles of flow. Calculate the test run average stack gas velocity by finding the arithmetic average of the point velocity results in accordance with sections 12.3 and 12.4, and calculate the stack gas volumetric flow rate in accordance with section 12.5 or 12.6, as applicable.

9.0 Quality Control

9.1 Quality Control Activities. In conjunction with the yaw angle determination and the pressure and temperature measurements specified in section 8.9, the following quality control checks should be performed.

9.1.1 Range of the differential pressure gauge. In accordance with the specifications in section 6.4, ensure that the proper differential pressure gauge is being used for the range of ΔP values encountered. If it is necessary to change to a more sensitive gauge, replace the gauge with a gauge calibrated according to section 10.3.3, perform the leak check described in section 8.4 and the zero check described in section 8.5, and repeat the differential pressure and temperature readings at each traverse point.

9.1.2 Horizontal stability check. For horizontal traverses of a stack or duct, visually check that the probe shaft is maintained in a horizontal position prior to taking a pressure reading. Periodically, during a test run, the probe's horizontal stability should be verified by placing a carpenter's level, a digital inclinometer, or other angle-measuring device on the portion of the probe sheath that extends outside of the test port. A comparable check should be performed by automated systems.

10.0 Calibration

10.1 Wind Tunnel Qualification Checks. To qualify for use in calibrating probes, a wind tunnel shall have the design features specified in section 6.11 and satisfy the following qualification criteria. The velocity pressure cross-check in section 10.1.1 and axial flow verification in section 10.1.2 shall be performed before the initial use of the wind tunnel and repeated immediately after any alteration occurs in the wind tunnel's configuration, fans, interior surfaces, straightening vanes, controls, or other properties that could reasonably be expected to alter the flow pattern or velocity stability in the tunnel. The owner or operator of a wind tunnel used to calibrate probes according to this method shall maintain records documenting that the wind tunnel meets the requirements of sections 10.1.1 and 10.1.2 and shall provide these records to the Administrator upon request.

10.1.1 Velocity pressure cross-check. To verify that the wind tunnel produces the same velocity at the tested probe head as at the calibration pitot tube impact port, perform the following cross-check. Take three differential pressure measurements at the fixed calibration pitot tube location, using the calibration pitot tube specified in section 6.10, and take three measurements with the calibration pitot tube at the wind tunnel calibration location, as defined in section 3.20. Alternate the measurements between the two positions. Perform this procedure at the lowest and highest velocity settings at which the probes will be calibrated. Record the values on a form similar to Table 2F–4. At each velocity setting, the average velocity pressure obtained at the wind tunnel calibration location shall be within ±2 percent or 2.5 mm H_2O (0.01 in. H_2O), whichever is less restrictive, of the average velocity pressure obtained at the fixed calibration pitot tube location. This comparative check shall be performed at 2.5-cm (1-in.), or smaller, intervals across the full length, width, and depth (if applicable) of the wind tunnel calibration location. If the criteria are not met at every tested point, the wind tunnel calibration location must be redefined, so that acceptable results are obtained at every point. Include the results of the velocity pressure cross-check in the calibration data section of the field test report. (See section 16.1.4.)

10.1.2 Axial flow verification. The following procedures shall be performed to demonstrate that there is fully developed axial flow within the calibration location and at the calibration pitot tube location. Two testing options are available to conduct this check.

10.1.2.1 Using a calibrated 3–D probe. A 3–D probe that has been previously calibrated in a wind tunnel with documented axial flow (as defined in section 3.21) may be used to conduct this check. Insert the calibrated 3–D probe into the wind tunnel test section using the tested probe port. Following the procedures in sections 8.9 and 12.2 of this method, determine the yaw and pitch angles at all the point(s) in the test section where the velocity pressure cross-check, as specified in section 10.1.1, is performed. This includes all the points in the calibration location and the point where the calibration pitot tube will be located. Determine the yaw and pitch angles at each point. Repeat these measurements at the highest and lowest velocities at which the probes will be calibrated. Record the values on a form similar to Table 2F–5. Each measured yaw and pitch angle shall be within ±3° of 0°. Exceeding the limits indicates unacceptable flow in the test section. Until the problem is corrected and acceptable flow is verified by repetition of this procedure, the wind tunnel shall not be used for calibration of probes. Include the results of the axial flow verification in the calibration data section of the field test report. (See section 16.1.4.)

10.1.2.2 Using alternative probes. Axial flow verification may be performed using an uncalibrated prism-shaped 3–D probe (e.g., DA or DAT probe) or an uncalibrated wedge probe. (Figure 2F–11 illustrates a typical wedge probe.) This approach requires use of two ports: the tested probe port and a second port located 90° from the tested probe port. Each port shall provide access to all the points within the wind tunnel test section where the velocity pressure cross-check, as specified in section 10.1.1, is conducted. The probe setup shall include establishing a reference yaw-null position on the probe sheath to serve as the location for installing the angle-measuring device. Physical design features of the DA, DAT, and wedge probes are relied on to determine the reference position. For the DA or DAT probe, this reference position can be determined by setting a digital inclinometer on the flat facet where the P_1 pressure port is located and then identifying the rotational position on the probe sheath where a second angle-measuring device would give the same angle reading. The reference position on a wedge probe shaft can be determined either geometrically or by placing a digital inclinometer on each side of the wedge and rotating the probe until equivalent readings are obtained. With the latter approach, the reference position is the rotational position on the probe sheath where an angle-measuring device would give a reading of 0°. After installing the angle-measuring device in the reference yaw-null position on the probe sheath, determine the yaw angle from the tested port. Repeat this measurement using the 90° offset port, which provides the pitch angle of flow. Determine the yaw and pitch angles at all the point(s) in the test section where the velocity pressure cross-check, as specified in section 10.1.1, is performed. This includes all the points in the wind tunnel calibration location and the point where the calibration pitot tube will be located. Perform this check at the highest and lowest velocities at which the probes will be calibrated. Record the values on a form similar to Table 2F–5. Each measured yaw and pitch angle shall be within ±3° of 0°. Exceeding the limits indicates unacceptable flow in the test section. Until the problem is corrected and acceptable flow is verified by repetition of this procedure, the wind tunnel shall not be used for calibration of probes. Include the results in the probe calibration report.

10.1.3 Wind tunnel audits.

10.1.3.1 Procedure. Upon the request of the Administrator, the owner or operator of a wind tunnel shall calibrate a 3–D audit probe in accordance with the procedures described in sections 10.3 through 10.6. The calibration shall be performed at two velocities and over a pitch angle range that encompasses the velocities and pitch angles typically used for this method at the facility. The resulting calibration data and curves shall be submitted to the Agency in an audit test report. These results shall be compared by the Agency to reference calibrations of the audit probe at the same velocity and pitch angle settings obtained at two different wind tunnels.

10.1.3.2 Acceptance criteria. The audited tunnel's calibration is acceptable if all of the following conditions are satisfied at each velocity and pitch setting for the reference calibration obtained from at least one of the wind tunnels. For pitch angle settings between −15° and +15°, no velocity calibration coefficient (i.e., F_2) may differ from the corresponding reference value by more than 3 percent. For pitch angle settings outside of this range (i.e., less than −15° and greater than +15°), no velocity calibration coefficient may differ by more than 5 percent from the corresponding reference value. If the acceptance criteria are not met, the audited wind tunnel shall not be used to calibrate probes for use under this method until the problems are resolved and acceptable results are obtained upon completion of a subsequent audit.

10.2 Probe Inspection. Before each calibration of a 3–D probe, carefully examine the physical condition of the probe head. Particular attention shall be paid to the edges of the pressure ports and the surfaces surrounding these ports. Any dents, scratches, or asymmetries on the edges of the pressure ports and any scratches or indentations on the surfaces surrounding the pressure ports shall be noted because of the potential effect on the probe's pressure readings. If the probe has been previously calibrated, compare the current condition of the probe's pressure ports and surfaces to the results of the inspection performed during the probe's most recent wind tunnel calibration. Record the results of this inspection on a form and in diagrams similar to Table 2F–1. The information in Table 2F–1 will be used as the basis for comparison during the probe head inspections performed before each subsequent field use.

10.3 Pre-Calibration Procedures. Prior to calibration, a scribe line shall have been placed on the probe in accordance with section 10.4. The yaw angle and velocity calibration procedures shall not begin until the pre-test requirements in sections 10.3.1 through 10.3.4 have been met.

10.3.1 Perform the horizontal straightness check described in section 8.2 on the probe assembly that will be calibrated in the wind tunnel.

10.3.2 Perform a leak check in accordance with section 8.4.

10.3.3 Except as noted in section 10.3.3.3, calibrate all differential pressure-measuring devices to be used in the probe calibrations, using the following procedures. At a minimum, calibrate these devices on each day that probe calibrations are performed.

10.3.3.1 Procedure. Before each wind tunnel use, all differential pressure-measuring devices shall be calibrated against the reference device specified in section 6.4.3 using a common pressure source. Perform the calibration at three reference pressures representing 30, 60, and 90 percent of the full-scale range of the pressure-measuring device being calibrated. For an inclined-vertical manometer, perform separate calibrations on the inclined and vertical portions of the measurement scale, considering each portion of the scale to be a separate full-scale range. [For example, for a manometer with a 0- to 2.5-cm H_2O (0- to 1-in. H_2O) inclined scale and a 2.5- to 12.7-cm H_2O (1- to 5-in. H_2O) vertical scale, calibrate the inclined portion at 7.6, 15.2, and 22.9 mm H_2O (0.3, 0.6, and 0.9 in. H_2O), and calibrate the vertical portion at 3.8, 7.6, and 11.4 cm H_2O (1.5, 3.0, and 4.5 in. H_2O).] Alternatively, for the vertical portion of the scale, use three evenly spaced reference pressures, one of which is equal to or higher than the highest differential pressure expected in field applications.

10.3.3.2 Acceptance criteria. At each pressure setting, the two pressure readings made using the reference device and the pressure-measuring device being calibrated shall agree to within ±2 percent of full scale of the device being calibrated or 0.5 mm H_2O (0.02 in. H_2O), whichever is less restrictive. For an inclined-vertical manometer, these requirements shall be met separately using the respective full-scale upper limits of the inclined and vertical portions of the scale. Differential pressure-measuring devices not meeting the ±2 percent of full scale or 0.5 mm H_2O (0.02 in. H_2O) calibration requirement shall not be used.

10.3.3.3 Exceptions. Any precision manometer that meets the specifications for a reference device in section 6.4.3 and that is not used for field testing does not require calibration, but must be leveled and zeroed before each wind tunnel use. Any pressure device used exclusively for yaw nulling does not require calibration, but shall be checked for responsiveness to rotation of the probe prior to each wind tunnel use.

10.3.4 Calibrate digital inclinometers on each day of wind tunnel or field testing (prior to beginning testing) using the following procedures. Calibrate the inclinometer according to the manufacturer's calibration procedures. In addition, use a triangular block (illustrated in Figure 2F-12) with a known angle, Θ, independently determined using a protractor or equivalent device, between two adjacent sides to verify the inclinometer readings.

Note: If other angle-measuring devices meeting the provisions of section 6.2.3 are used in place of a digital inclinometer, comparable calibration procedures shall be performed on such devices.)

Secure the triangular block in a fixed position. Place the inclinometer on one side of the block (side A) to measure the angle of inclination (R_1). Repeat this measurement on the adjacent side of the block (side B) using the inclinometer to obtain a second angle reading (R_2). The difference of the sum of the two readings from 180° (i.e., 180° $- R_1 - R_2$) shall be within ±2° of the known angle, Θ.

10.4 Placement of Reference Scribe Line. Prior to the first calibration of a probe, a line shall be permanently inscribed on the main probe sheath to serve as a reference mark for determining yaw angles. Annex C in section 18 of this method gives a guideline for placement of the reference scribe line.

10.4.1 This reference scribe line shall meet the specifications in sections 6.1.6.1 and 6.1.6.3 of this method. To verify that the alignment specification in section 6.1.6.3 is met, secure the probe in a horizontal position and measure the rotational angle of each scribe line and scribe line segment using an angle-measuring device that meets the specifications in section 6.2.1 or 6.2.3. For any scribe line that is longer than 30.5 cm (12 in.), check the line's rotational position at 30.5-cm (12-in.) intervals. For each line segment that is 30.5 cm (12 in.) or less in length, check the rotational position at the two endpoints of the segment. To meet the alignment specification in section 6.1.6.3, the minimum and maximum of all of the rotational angles that are measured along the full length of the main probe must not differ by more than 2°.

Note: A short reference scribe line segment [e.g., 15.2 cm (6 in.) or less in length] meeting the alignment specifications in section 6.1.6.3 is fully acceptable under this method. See section 18.1.1.1 of Annex A for an example of a probe marking procedure, suitable for use with a short reference scribe line.

10.4.2 The scribe line should be placed on the probe first and then its offset from the yaw-null position established (as specified in section 10.5). The rotational position of the reference scribe line relative to the yaw-null position of the probe, as determined by the yaw angle calibration procedure in section 10.5, is defined as the reference scribe line rotational offset, R_{SLO}. The reference scribe line rotational offset shall be recorded and retained as part of the probe's calibration record.

10.4.3 Scribe line for automated probes. A scribe line may not be necessary for an automated probe system if a reference rotational position of the probe is built into the probe system design. For such systems, a "flat" (or comparable, clearly identifiable physical characteristic) should be provided on the probe casing or flange plate to ensure that the reference position of the probe assembly remains in a vertical or horizontal position. The rotational offset of the flat (or comparable, clearly identifiable physical characteristic) needed to orient the reference position of the probe assembly shall be recorded and maintained as part of the automated probe system's specifications.

10.5 Yaw Angle Calibration Procedure. For each probe used to measure yaw angles with this method, a calibration procedure shall be performed in a wind tunnel meeting the specifications in section 10.1 to determine the rotational position of the reference scribe line relative to the probe's yaw-null position. This procedure shall be performed on the main probe with all devices that will be attached to the main probe in the field [such as thermocouples or resistance temperature detectors (RTDs)] that may affect the flow around the probe head. Probe shaft extensions that do not affect flow around the probe head need not be attached during calibration. At a minimum, this procedure shall include the following steps.

10.5.1 Align and lock the angle-measuring device on the reference scribe line. If a marking procedure (such as that described in section 18.1.1.1) is used, align the angle-measuring device on a mark within ±1° of the rotational position of the reference scribe line. Lock the angle-measuring device onto the probe sheath at this position.

10.5.2 Zero the pressure-measuring device used for yaw nulling.

10.5.3 Insert the probe assembly into the wind tunnel through the entry port, positioning the probe's impact port at the calibration location. Check the responsiveness of the pressure-measurement device to probe rotation, taking corrective action if the response is unacceptable.

10.5.4 Ensure that the probe is in a horizontal position, using a carpenter's level.

10.5.5 Rotate the probe either clockwise or counterclockwise until a yaw null ($P_2 = P_3$) is obtained.

10.5.6 Use the reading displayed by the angle-measuring device at the yaw-null position to determine the magnitude of the reference scribe line rotational offset, R_{SLO}, as defined in section 3.15. Annex D in section 18 of this method provides a recommended procedure for determining the magnitude of R_{SLO} with a digital inclinometer and a second procedure for determining the magnitude of R_{SLO} with a protractor wheel and pointer device. Table 2F-6 presents an example data form and Table 2F-7 is a look-up table with the recommended procedure. Procedures other than those recommended in Annex D in section 18 may be used, if they can determine R_{SLO} to within ±1° and are explained in detail in the field test report. The algebraic sign of R_{SLO} will either be positive, if the rotational position of the reference scribe line (as viewed from the "tail" end of the probe) is clockwise, or negative, if counterclockwise with respect to the probe's yaw-null position. (This is illustrated in Figure 2F-13.)

10.5.7 The steps in sections 10.5.3 through 10.5.6 shall be performed twice at each of the velocities at which the probe will be calibrated (in accordance with section 10.6). Record the values of R_{SLO}.

10.5.8 The average of all of the R_{SLO} values shall be documented as the reference scribe line rotational offset for the probe.

10.5.9 Use of reference scribe line offset. The reference scribe line rotational offset shall be used to determine the yaw angle of flow in accordance with section 8.9.4.

10.6 Pitch Angle and Velocity Pressure Calibrations. Use the procedures in sections 10.6.1 through 10.6.16 to generate an appropriate set (or sets) of pitch angle and velocity pressure calibration curves for each probe. The calibration procedure shall be performed on the main probe and all devices that will be attached to the main probe in the field (e.g., thermocouple or RTDs) that may affect the flow around the probe head. Probe shaft extensions that do not affect flow around the probe head need not be attached during calibration. (Note: If a sampling nozzle is part of the assembly, a wind tunnel demonstration shall be performed that shows the probe's ability to measure velocity and yaw null is not impaired when the nozzle is drawing a sample.) The calibration procedure involves generating two calibration curves, F_1 versus pitch angle and F_2 versus pitch angle. To generate these two curves, F_1 and F_2 shall be derived using Equations 2F-1 and 2F-2, below. Table 2F-8 provides an example wind tunnel calibration data sheet, used to log the measurements needed to derive these two calibration curves.

10.6.1 Calibration velocities. The tester may calibrate the probe at two nominal wind tunnel velocity settings of 18.3 m/sec and 27.4 m/sec (60 ft/sec and 90 ft/sec) and average the results of these calibrations, as described in section 10.6.16.1, in order to generate a set of calibration curves. If this option is selected, this single set of calibration curves may be used for all field applications over the entire velocity range allowed by the method. Alternatively, the tester may customize the probe calibration for a particular field test application (or for a series of applications), based on the expected average velocity(ies) at the test site(s). If this option is selected, generate each set of calibration curves by calibrating the probe at two nominal wind tunnel velocity settings, at least one of which is greater than or equal to the expected average velocity(ies) for the field application(s), and average the results as described in section 10.6.16.1. Whichever calibration option is selected, the probe calibration coefficients (F_2 values) obtained at the two nominal calibration velocities shall, for the same pitch angle setting, meet the conditions specified in section 10.6.16.

10.6.2 Pitch angle calibration curve (F − 1) versus pitch angle). The pitch angle calibration involves generating a calibration curve of calculated F_1 values versus tested pitch angles, where F_1 is the ratio of the pitch pressure to the velocity pressure, i.e.,

$$F_1 = \frac{(P_4 - P_5)}{(P_1 - P_2)} \qquad \text{Eq. 2F-1}$$

See Figure 2F-14 for an example F_1 versus pitch angle calibration curve.

10.6.3 Velocity calibration curve (F_2 versus pitch angle). The velocity calibration involves generating a calibration curve of the 3-D probe's F_2 coefficient against the tested pitch angles, where

$$F_2 = C_p\sqrt{\frac{\Delta P_{std}}{(P_1 - P_2)}} \qquad \text{Eq. 2F-2}$$

and

C_p = calibration pitot tube coefficient, and
ΔP_{std} = velocity pressure from the calibration pitot tube.

See Figure 2F-15 for an example F_2 versus pitch angle calibration curve.

10.6.4 Connect the tested probe and calibration pitot probe to their respective pressure-measuring devices. Zero the pressure-measuring devices. Inspect and leak-check all pitot lines; repair or replace, if necessary. Turn on the fan, and allow the wind tunnel air flow to stabilize at the first of the two selected nominal velocity settings.

10.6.5 Position the calibration pitot tube at its measurement location (determined as outlined in section 6.11.4.3), and align the tube so that its tip is pointed directly into the flow. Ensure that the entry port surrounding the tube is properly sealed. The calibration pitot tube may either remain in the wind tunnel throughout the calibration, or be removed from the wind tunnel while measurements are taken with the probe being calibrated.

10.6.6 Set up the pitch protractor plate on the tested probe's entry port to establish the pitch angle positions of the probe to within ±2°.

10.6.7 Check the zero setting of each pressure-measuring device.

10.6.8 Insert the tested probe into the wind tunnel and align it so that its P_1 pressure port is pointed directly into the flow and is positioned within the calibration location (as defined in section 3.20). Secure the probe at the 0° pitch angle position. Ensure that the entry port surrounding the probe is properly sealed.

10.6.9 Read the differential pressure from the calibration pitot tube (ΔP_{std}), and record its value. Read the barometric pressure to within ±2.5 mm Hg (±0.1 in. Hg) and the temperature in the wind tunnel to within 0.6°C (1°F). Record these values on a data form similar to Table 2F-8.

10.6.10 After the tested probe's differential pressure gauges have had sufficient time to stabilize, yaw null the probe, then obtain differential pressure readings for (P_1−P_2) and (P_4−P_5). Record the yaw angle and differential pressure readings. After taking these readings, ensure that the tested probe has remained at the yaw-null position.

10.6.11 Either take paired differential pressure measurements with both the calibration pitot tube and tested probe (according to sections 10.6.9 and 10.6.10) or take readings only with the tested probe (according to section 10.6.10) in 5° increments over the pitch-angle range for which the probe is to be calibrated. The calibration pitch-angle range shall be symmetric around 0° and shall exceed the largest pitch angle expected in the field by 5°. At a minimum, probes shall be calibrated over the range of −15° to +15°. If paired calibration pitot tube and tested probe measurements are not taken at each pitch angle setting, the differential pressure from the calibration pitot tube shall be read, at a minimum, before taking the tested probe's differential pressure reading at the first pitch angle setting and after taking the tested probe's differential pressure readings at the last pitch angle setting in each replicate.

10.6.12 Perform a second replicate of the procedures in sections 10.6.5 through 10.6.11 at the same nominal velocity setting.

10.6.13 For each replicate, calculate the F_1 and F_2 values at each pitch angle. At each pitch angle, calculate the percent difference between the two F_2 values using Equation 2F-3.

$$\%\text{Diff} = \frac{F_2^{max} - F_2^{min}}{F_2^{min}} \times 100\% \qquad \text{Eq. 2F-3}$$

Eq. 2F-3

If the percent difference is less than or equal to 2 percent, calculate an average F_1 value and an average F_2 value at that pitch angle. If the percent difference is greater than 2 percent and less than or equal to 5 percent, perform a third repetition at that angle and calculate an average F_1 value and an average F_2 value using all three repetitions. If the percent difference is greater than 5 percent, perform four additional repetitions at that angle and calculate an average F_1 value and an average F_2 value using all six repetitions. When additional repetitions are required at any pitch angle, move the probe by at least 5° and then return to the specified pitch angle before taking the next measurement. Record the average values on a form similar to Table 2F-9.

10.6.14 Repeat the calibration procedures in sections 10.6.5 through 10.6.13 at the second selected nominal wind tunnel velocity setting.

10.6.15 Velocity drift check. The following check shall be performed, except when paired calibration pitot tube and tested probe pressure measurements are taken at each pitch angle setting. At each velocity setting, calculate the percent difference between consecutive differential pressure measurements made with the calibration pitot tube. If a measurement differs from the previous measurement by more than 2 percent or 0.25 mm H_2O (0.01 in. H_2O), whichever is less restrictive, the calibration data collected between these calibration pitot tube measurements may not be used, and the measurements shall be repeated.

10.6.16 Compare the averaged F_2 coefficients obtained from the calibrations at the two selected nominal velocities, as follows. At each pitch angle setting, use Equation 2F-3 to calculate the difference between the corresponding average F_2 values at the two calibration velocities. At each pitch angle in the −15° to +15° range, the percent difference between the average F_2 values shall not exceed 3.0 percent. For pitch angles outside this range (i.e., less than −15°0 and greater than +15°), the percent difference shall not exceed 5.0 percent.

10.6.16.1 If the applicable specification in section 10.6.16 is met at each pitch angle setting, average the results obtained at the two nominal calibration velocities to produce a calibration record of F_1 and F_2 at each pitch angle tested. Record these values on a form similar to Table 2F-9. From these values, generate one calibration curve representing F_1 versus pitch angle and a second curve representing F_2 versus pitch angle. Computer spreadsheet programs may be used to graph the calibration data and to develop polynomial equations that can be used to calculate pitch angles and axial velocities.

10.6.16.2 If the applicable specification in section 10.6.16 is exceeded at any pitch angle setting, the probe shall not be used unless: (1) the calibration is repeated at that pitch angle and acceptable results are obtained or (2) values of F_1 and F_2 are obtained at two nominal velocities for which the specifications in section 10.6.16 are met across the entire pitch angle range.

10.7 Recalibration. Recalibrate the probe using the procedures in section 10 either within 12 months of its first field use after its most recent calibration or after 10 field tests (as defined in section 3.4), whichever occurs later. In addition, whenever there is visible damage to the 3-D head, the probe shall be recalibrated before it is used again.

10.8 Calibration of pressure-measuring devices used in field tests. Before its initial use in a field test, calibrate each pressure-measuring device (except those used exclusively for yaw nulling) using the three-point calibration procedure described in section 10.3.3. The device shall be recalibrated according to the procedure in section 10.3.3 no later than 90 days after its first field use following its most recent calibration. At the discretion of the tester, more frequent calibrations (e.g., after a field test) may be performed. No adjustments, other than adjustments to the zero setting, shall be made to the device between calibrations

10.8.1 Post-test calibration check. A single-point calibration check shall be performed on each pressure-measuring device after completion of each field test. At the discretion of the tester, more frequent single-point calibration checks (e.g., after one or more field test runs) may be performed. It is recommended that the post-test check be performed before leaving the field test site. The check shall be performed at a pressure between 50 and 90 percent of full scale by taking a common pressure reading with the tested device and a reference pressure-measuring device (as described in section 6.4.4) or by challenging the tested device with a reference pressure source (as described in section 6.4.4) or by performing an equivalent check using a reference device approved by the Administrator.

10.8.2 Acceptance criterion. At the selected pressure setting, the pressure readings made using the reference device and the tested device shall agree to within 3 percent of full scale of the tested device or 0.8 mm H_2O (0.03 in. H_2O), whichever is less restrictive. If this specification is met, the test data collected during the field test are valid. If the specification is not met, all test data collected since the last successful calibration or calibration check are invalid and shall be repeated using a pressure-measuring device with a current, valid calibration. Any device that fails the calibration check shall not be used in a field test until a successful recalibration is performed according to the procedures in section 10.3.3.

10.9 Temperature Gauges. Same as Method 2, section 4.3. The alternative thermocouple calibration procedures outlined in Emission Measurement Center (EMC) Approved Alternative Method (ALT-011) "Alternative Method 2 Thermocouple Calibration Procedure" may be performed. Temperature gauges shall be calibrated no more than 30 days prior to the start of a field test or series of field tests and recalibrated no more than 30 days after completion of a field test or series of field tests.

10.10 Barometer. Same as Method 2, section 4.4. The barometer shall be calibrated no more than 30 days prior to the start of a field test or series of field tests.

11.0 Analytical Procedure

Sample collection and analysis are concurrent for this method (see section 8.0).

12.0 Data Analysis and Calculations

These calculations use the measured yaw angle, derived pitch angle, and the differential pressure and temperature measurements at individual traverse points to derive the axial flue gas velocity ($v_{a(i)}$) at each of those points. The axial velocity values at all traverse points that comprise a full stack or duct traverse are then averaged to obtain the average axial flue gas velocity (v_a (avg)). Round off figures only in the final calculation of reported values.

12.1 Nomenclature

A = Cross-sectional area of stack or duct, m^2 (ft^2).

B_{ws} = Water vapor in the gas stream (from Method 4 or alternative), proportion by volume.

Kp = Conversion factor (a constant),

$$34.97 \frac{m}{sec}\left[\frac{(g/g\text{-mole})(mm\ Hg)}{(^\circ K)(mm\ H_2O)}\right]^{1/2}$$

for the metric system, and

$$85.49 \frac{ft}{sec}\left[\frac{(lb/lb\text{-mole})(in.\ Hg)}{(^\circ R)(in.\ H_2O)}\right]^{1/2}$$

for the English system.

M_d = Molecular weight of stack or duct gas, dry basis (see section 8.13), g/g-mole (lb/lb-mole).

M_s = Molecular weight of stack or duct gas, wet basis, g/g-mole (lb/lb-mole).

$$M_s = M_d(1 - B_{ws}) + 18.0 B_{ws} \qquad \text{Eq. 2F-4}$$

P_{bar} = Barometric pressure at measurement site, mm Hg (in. Hg).

P_g = Stack or duct static pressure, mm H_2O (in. H_2O).

P_s = Absolute stack or duct pressure, mm Hg (in. Hg).

$$P_s = P_{bar} + \frac{P_g}{13.6} \qquad \text{Eq. 2F-5}$$

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

13.6 = Conversion from mm H_2O (in. H_2O) to mm Hg (in. Hg).

Q_{sd} = Average dry-basis volumetric stack or duct gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).

Q_{sw} = Average wet-basis volumetric stack or duct gas flow rate corrected to standard conditions, wscm/hr (wscf/hr).

$T_{s(avg)}$ = Average absolute stack or duct gas temperature across all traverse points.

$t_{s(i)}$ = Stack or duct gas temperature, C (F), at traverse point i.

$T_{s(i)}$ = Absolute stack or duct gas temperature, K (R), at traverse point i,

$$T_{s(i)} = 273 + t_{s(i)} \qquad \text{Eq. 2F-6}$$

for the metric system, and

$$T_{s(i)} = 460 + t_{s(i)} \qquad \text{Eq. 2F-7}$$

for the English system.

T_{std} = Standard absolute temperature, 293°K (528°R).

$F_{1(i)}$ = Pitch angle ratio, applicable at traverse point i, dimensionless.

$F_{2(i)}$ = 3-D probe velocity calibration coefficient, applicable at traverse point i, dimensionless.

$(P_4\text{-}P_5)_i$ = Pitch differential pressure of stack or duct gas flow, mm H_2O (in. H_2O), at traverse point i.

$(P_1\text{-}P_2)_i$ = Velocity head (differential pressure) of stack or duct gas flow, mm H_2O (in. H_2O), at traverse point i.

$v_{a(i)}$ = Reported stack or duct gas axial velocity, m/sec (ft/sec), at traverse point i.

$v_{a(avg)}$ = Average stack or duct gas axial velocity, m/sec (ft/sec), across all traverse points.

3,600 = Conversion factor, sec/hr.

18.0 = Molecular weight of water, g/g-mole (lb/lb-mole).

$\theta_{y(i)}$ = Yaw angle, degrees, at traverse point i.

$\theta_{p(i)}$ = Pitch angle, degrees, at traverse point i.

n = Number of traverse points.

12.2 Traverse Point Velocity Calculations. Perform the following calculations from the measurements obtained at each traverse point.

12.2.1 Selection of calibration curves. Select calibration curves as described in section 10.6.1.

12.2.2 Traverse point pitch angle ratio. Use Equation 2F–1, as described in section 10.6.2, to calculate the pitch angle ratio, $F_{1(i)}$, at each traverse point.

12.2.3 Pitch angle. Use the pitch angle ratio, $F_{1(i)}$, to derive the pitch angle, $\theta_{p(i)}$, at traverse point i from the F_1 versus pitch angle calibration curve generated under section 10.6.16.1.

12.2.4 Velocity calibration coefficient. Use the pitch angle, $\theta_{p(i)}$, to obtain the probe velocity calibration coefficient, $F_{2(i)}$, at traverse point i from the "velocity pressure calibration curve," i.e., the F_2 versus pitch angle calibration curve generated under section 10.6.16.1.

12.2.5 Axial velocity. Use the following equation to calculate the axial velocity, $v_{a(i)}$, from the differential pressure $(P_1\text{-}P_2)_i$ and yaw angle, $\theta_{y(i)}$, measured at traverse point i and the previously calculated values for the velocity calibration coefficient, $F_{2(i)}$, absolute stack or duct standard temperature, $T_{s(i)}$, absolute stack or duct pressure, P_s, molecular weight, M_s, and pitch angle, "$\theta_{p(i)}$.

$$v_{a(i)} = K_p F_{2(i)} \sqrt{\frac{(P_1 - P_2)_i T_{s(i)}}{P_s M_s}} \left(\cos\theta_{y(i)}\right)\left(\cos\theta_{p(i)}\right) \quad \text{Eq. 2F-8}$$

12.2.6 Handling multiple measurements at a traverse point. For pressure or temperature devices that take multiple measurements at a traverse point, the multiple measurements (or where applicable, their square roots) may first be averaged and the resulting average values used in the equations above. Alternatively, the individual measurements may be used in the equations above and the resulting multiple calculated values may then be averaged to obtain a single traverse point value. With either approach, all of the individual measurements recorded at a traverse point must be used in calculating the applicable traverse point value.

12.3 Average Axial Velocity in Stack or Duct. Use the reported traverse point axial velocity in the following equation.

$$v_{a(avg)} = \frac{\sum_{i=1}^{n} v_{a(i)}}{n} \quad \text{Eq. 2F-9}$$

12.4 Acceptability of Results. The test results are acceptable and the calculated value of $v_{a(avg)}$ may be reported as the average axial velocity for the test run if the conditions in either section 12.4.1 or 12.4.2 are met.

12.4.1 The calibration curves were generated at nominal velocities of 18.3 m/sec and 27.4 m/sec (60 ft/sec and 90 ft/sec).

12.4.2 The calibration curves were generated at nominal velocities other than 18.3 m/sec and 27.4 m/sec (60 ft/sec and 90 ft/sec), and the value of $v_{a(avg)}$ obtained using Equation 2F-9 is less than or equal to at least one of the nominal velocities used to derive the F_1 and F_2 calibration curves.

12.4.3 If the conditions in neither section 12.4.1 nor section 12.4.2 are met, the test results obtained in Equation 2F-9 are not acceptable, and the steps in sections 12.2 and 12.3 must be repeated using a set of F_1 and F_2 calibration curves that satisfies the conditions specified in section 12.4.1 or 12.4.2.

12.5 Average Gas Wet Volumetric Flow Rate in Stack or Duct. Use the following equation to compute the average volumetric flow rate on a wet basis.

$$Q_{sw} = 3{,}600\left(v_{a(avg)}\right)(A)\left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right) \quad \text{Eq. 2F-10}$$

12.6 Average Gas Dry Volumetric Flow Rate in Stack or Duct. Use the following equation to compute the average volumetric flow rate on a dry basis.

$$Q_{sd} = 3{,}600(1 - B_{ws})\left(v_{a(avg)}\right)(A)\left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right) \quad \text{Eq. 2F-11}$$

13.0 Method Performance. [Reserved]

14.0 Pollution Prevention. [Reserved]

15.0 Waste Management. [Reserved]

16.0 Reporting

16.1 Field Test Reports. Field test reports shall be submitted to the Agency according to applicable regulatory requirements. Field test reports should, at a minimum, include the following elements.

16.1.1 Description of the source. This should include the name and location of the test site, descriptions of the process tested, a description of the combustion source, an accurate diagram of stack or duct cross-sectional area at the test site showing the dimensions of the stack or duct, the location of the test ports, and traverse point locations and identification numbers or codes. It should also include a description and diagram of the stack or duct layout, showing the distance of the test location from the nearest upstream and downstream disturbances and all structural elements (including breachings, baffles, fans, straighteners, etc.) affecting the flow pattern. If the source and test location descriptions have been previously submitted to the Agency in a document (e.g., a monitoring plan or test plan), referencing the document in lieu of including this information in the field test report is acceptable.

16.1.2 Field test procedures. These should include a description of test equipment and test procedures. Testing conventions, such as traverse point numbering and measurement sequence (e.g., sampling from center to wall, or wall to center), should be clearly stated. Test port identification and directional reference for each test port should be included on the appropriate field test data sheets.

16.1.3 Field test data.

16.1.3.1 Summary of results. This summary should include the dates and times of testing and the average axial gas velocity and the average flue gas volumetric flow results for each run and tested condition.

16.1.3.2 Test data. The following values for each traverse point should be recorded and reported:

(a) P_1-P_2 and P_4-P_5 differential pressures
(b) Stack or duct gas temperature at traverse point i ($t_{s(i)}$)
(c) Absolute stack or duct gas temperature at traverse point i ($T_{s(i)}$)
(d) Yaw angle at each traverse point i ($\theta_{y(i)}$)
(e) Pitch angle at each traverse point i ($\theta_{p(i)}$)
(f) Stack or duct gas axial velocity at traverse point i ($v_{a(i)}$)

16.1.3.3 The following values should be reported once per run:

(a) Water vapor in the gas stream (from Method 4 or alternative), proportion by volume (B_{ws}), measured at the frequency specified in the applicable regulation
(b) Molecular weight of stack or duct gas, dry basis (M_d)
(c) Molecular weight of stack or duct gas, wet basis (M_s)
(d) Stack or duct static pressure (P_g)
(e) Absolute stack or duct pressure (P_s)
(f) Carbon dioxide concentration in the flue gas, dry basis ($\%_d$ CO_2)
(g) Oxygen concentration in the flue gas, dry basis ($\%_d$ O_2)
(h) Average axial stack or duct gas velocity ($v_{a(avg)}$) across all traverse points
(i) Gas volumetric flow rate corrected to standard conditions, dry or wet basis as required by the applicable regulation (Q_{sd} or Q_{sw})

16.1.3.4 The following should be reported once per complete set of test runs:

(a) Cross-sectional area of stack or duct at the test location (A)
(b) Measurement system response time (sec)
(c) Barometric pressure at measurement site (P_{bar})

16.1.4 Calibration data. The field test report should include calibration data for all probes and test equipment used in the field test. At a minimum, the probe calibration data reported to the Agency should include the following:

(a) Date of calibration
(b) Probe type
(c) Probe identification number(s) or code(s)
(d) Probe inspection sheets

(e) Pressure measurements and intermediate calculations of F_1 and F_2 at each pitch angle used to obtain calibration curves in accordance with section 10.6 of this method
(f) Calibration curves (in graphic or equation format) obtained in accordance with sections 10.6.11 of this method
(g) Description and diagram of wind tunnel used for the calibration, including dimensions of cross-sectional area and position and size of the test section
(h) Documentation of wind tunnel qualification tests performed in accordance with section 10.1 of this method

16.1.5 Quality Assurance. Specific quality assurance and quality control procedures used during the test should be described.

17.0 Bibliography

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(3) 40 CFR Part 60, Appendix A, Method 2—Determination of stack gas velocity and volumetric flow rate (Type S pitot tube).
(4) 40 CFR Part 60, Appendix A, Method 3—Gas analysis for carbon dioxide, oxygen, excess air, and dry molecular weight.
(5) 40 CFR Part 60, Appendix A, Method 3A—Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources (instrumental analyzer procedure).
(6) 40 CFR Part 60, Appendix A, Method 4—Determination of moisture content in stack gases
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18.0 Annexes

Annex A, C, and D describe recommended procedures for meeting certain provisions in sections 8.3, 10.4, and 10.5 of this method. Annex B describes procedures to be followed when using the protractor wheel and pointer assembly to measure yaw angles, as provided under section 8.9.1.

18.1 Annex A—Rotational Position Check. The following are recommended procedures that may be used to satisfy the rotational position check requirements of section 8.3 of this method and to determine the angle-measuring device rotational offset (RADO).

18.1.1 Rotational position check with probe outside stack. Where physical constraints at the sampling location allow full assembly of the probe outside the stack and insertion into the test port, the following procedures should be performed before the start of testing. Two angle-measuring devices that meet the specifications in section 6.2.1 or 6.2.3 are required for the rotational position check. An angle measuring device whose position can be independently adjusted (e.g., by means of a set screw) after being locked into position on the probe sheath shall not be used for this check unless the independent adjustment is set so that the device performs exactly like a device without the capability for independent adjustment. That is, when aligned on the probe such a device must give the same reading as a device that does not have the capability of being independently adjusted. With the fully assembled probe (including probe shaft extensions, if any) secured in a horizontal position, affix one yaw angle-measuring device to the probe sheath and lock it into position on the reference scribe line specified in section 6.1.6.1. Position the second angle-measuring device using the procedure in section 18.1.1.1 or 18.1.1.2.

18.1.1.1 Marking procedure. The procedures in this section should be performed at each location on the fully assembled probe where the yaw angle-measuring device will be mounted during the velocity traverse. Place the second yaw angle-measuring device on the main probe sheath (or extension) at the position where a yaw angle will be measured during the velocity traverse. Adjust the position of the second angle-measuring device until it indicates the same angle (±1°) as the reference device, and affix the second device to the probe sheath (or extension). Record the angles indicated by the two angle-measuring devices on a form similar to Table 2F-2. In this position, the second angle-measuring device is considered to be properly positioned for yaw angle measurement. Make a mark, no wider than 1.6 mm (1/16 in.), on the probe sheath (or extension), such that the yaw angle-measuring device can be re-affixed at this same properly aligned position during the velocity traverse.

18.1.1.2 Procedure for probe extensions with scribe lines. If, during a velocity traverse the angle-measuring device will be affixed to a probe extension having a scribe line as specified in section 6.1.6.2, the following procedure may be used to align the extension's scribe line with the reference scribe line instead of marking the extension as described in section 18.1.1.1. Attach the probe extension to the main probe. Align and lock the second angle-measuring device on the probe extension's scribe line. Then, rotate the extension until both measuring devices indicate the same angle (±1°). Lock the extension at this rotational position. Record the angles indicated by the two angle-measuring devices on a form similar to Table 2F–2. An angle-measuring device may be aligned at any position on this scribe line during the velocity traverse, if the scribe line meets the alignment specification in section 6.1.6.3.

18.1.1.3 Post-test rotational position check. If the fully assembled probe includes one or more extensions, the following check should be performed immediately after the completion of a velocity traverse. At the discretion of the tester, additional checks may be conducted after completion of testing at any sample port. Without altering the alignment of any of the components of the probe assembly used in the velocity traverse, secure the fully assembled probe in a horizontal position. Affix an angle-measuring device at the reference scribe line specified in section 6.1.6.1. Use the other angle-measuring device to check the angle at each location where the device was checked prior to testing. Record the readings from the two angle-measuring devices.

18.1.2 Rotational position check with probe in stack. This section applies only to probes that, due to physical constraints, cannot be inserted into the test port as fully assembled with all necessary extensions needed to reach the inner-most traverse point(s).

18.1.2.1 Perform the out-of-stack procedure in section 18.1.1 on the main probe and any attached extensions that will be initially inserted into the test port.

18.1.2.2 Use the following procedures to perform additional rotational position check(s) with the probe in the stack, each time a probe extension is added. Two angle-measuring devices are required. The first of these is the device that was used to measure yaw angles at the preceding traverse point, left in its properly aligned measurement position. The second angle-measuring device is positioned on the added probe extension. Use the applicable procedures in section 18.1.1.1 or 18.1.1.2 to align, adjust, lock, and mark (if necessary) the position of the second angle-measuring device to within ±1° of the first device. Record the readings of the two devices on a form similar to Table 2F–2.

18.1.2.3 The procedure in section 18.1.2.2 should be performed at the first port where measurements are taken. The procedure should be repeated each time a probe extension is re-attached at a subsequent port, unless the probe extensions are designed to be locked into a mechanically fixed rotational position (e.g., through use of interlocking grooves), which can be reproduced from port to port as specified in section 8.3.5.2.

18.2 Annex B—Angle Measurement Protocol for Protractor Wheel and Pointer Device. The following procedure shall be used when a protractor wheel and pointer assembly, such as the one described in section 6.2.2 and illustrated in Figure 2F–7 is used to measure the yaw angle of flow. With each move to a new traverse point, unlock, re-align, and re-lock the probe, angle-pointer collar, and protractor wheel to each other. At each such move, particular attention is required to ensure that the scribe line on the angle pointer collar is either aligned with the reference scribe line on the main probe sheath or is at the rotational offset position established under section 8.3.1. The procedure consists of the following steps:

18.2.1 Affix a protractor wheel to the entry port for the test probe in the stack or duct.

18.2.2 Orient the protractor wheel so that the 0° mark corresponds to the longitudinal axis of the stack or duct. For stacks, vertical ducts, or ports on the side of horizontal ducts, use a digital inclinometer meeting the specifications in section 6.2.1 to locate the 0° orientation. For ports on the top or bottom of horizontal ducts, identify the longitudinal axis at each test port and permanently mark the duct to indicate the 0° orientation. Once the protractor wheel is properly aligned, lock it into position on the test port.

18.2.3 Move the pointer assembly along the probe sheath to the position needed to take measurements at the first traverse point. Align the scribe line on the pointer collar with the reference scribe line or at the rotational offset position established under section 8.3.1. Maintaining this rotational alignment, lock the pointer device onto the probe sheath. Insert the probe into the entry port to the depth needed to take measurements at the first traverse point.

18.2.4 Perform the yaw angle determination as specified in sections 8.9.3 and 8.9.4 and record the angle as shown by the pointer on the protractor wheel. Then, take velocity pressure and temperature measurements in accordance with the procedure in section 8.9.5. Perform the alignment check described in section 8.9.6.

18.2.5 After taking velocity pressure measurements at that traverse point, unlock the probe from the collar and slide the probe through the collar to the depth needed to reach the next traverse point.

18.2.6 Align the scribe line on the pointer collar with the reference scribe line on the main probe or at the rotational offset position established under section 8.3.1. Lock the collar onto the probe.

18.2.7 Repeat the steps in sections 18.2.4 through 18.2.6 at the remaining traverse points accessed from the current stack or duct entry port.

18.2.8 After completing the measurement at the last traverse point accessed from a port, verify that the orientation of the protractor wheel on the test port has not changed over the course of the traverse at that port. For stacks, vertical ducts, or ports on the side of horizontal ducts, use a digital inclinometer meeting the specifications in section 6.2.1 to check the rotational position of the 0° mark on the protractor wheel. For ports on the top or bottom of horizontal ducts, observe the alignment of the angle wheel 0° mark relative to the permanent 0° mark on the duct at that test port. If these observed comparisons exceed ±2° of 0°, all angle and pressure measurements taken at that port since the protractor wheel was last locked into position on the port shall be repeated.

18.2.9 Move to the next stack or duct entry port and repeat the steps in sections 18.2.1 through 18.2.8.

18.3 Annex C—Guideline for Reference Scribe Line Placement. Use of the following guideline is recommended to satisfy the requirements of section 10.4 of this method. The rotational position of the reference scribe line should be either 90° or 180° from the probe's impact pressure port.

18.4 Annex D—Determination of Reference Scribe Line Rotational Offset. The following procedures are recommended for determining the magnitude and sign of a probe's reference scribe line rotational offset, R_{SLO}. Separate procedures are provided for two types of angle-measuring devices: digital inclinometers and protractor wheel and pointer assemblies.

18.4.1 Perform the following procedures on the main probe with all devices that will be attached to the main probe in the field [such as thermocouples or resistance temperature detectors (RTDs)] that may affect the flow around the probe head. Probe shaft extensions that do not affect flow around the probe head need not be attached during calibration.

18.4.2 The procedures below assume that the wind tunnel duct used for probe calibration is horizontal and that the flow in the calibration wind tunnel is axial as determined by the axial flow verification check described in section 10.1.2. Angle-measuring devices are assumed to display angles in alternating 0° to 90° and 90° to 0° intervals. If angle-measuring devices with other readout conventions are used or if other calibration wind tunnel duct configurations are used, make the appropriate calculational corrections.

18.4.2.1 Position the angle-measuring device in accordance with one of the following procedures.

18.4.2.1.1 If using a digital inclinometer, affix the calibrated digital inclinometer to the probe. If the digital inclinometer can be independently adjusted after being locked into position on the probe sheath (e.g., by means of a set screw), the independent adjustment must be set so that the device performs exactly like a device without the capability for independent adjustment. That is, when aligned on the probe the device must give the same readings as a device that does not have the capability of being independently adjusted. Either align it directly on the reference scribe line or on a mark aligned with the scribe line determined according to the procedures in section 18.1.1.1. Maintaining this rotational alignment, lock the digital inclinometer onto the probe sheath.

18.4.2.1.2 If using a protractor wheel and pointer device, orient the protractor wheel on the test port so that the 0° mark is aligned with the longitudinal axis of the wind tunnel duct. Maintaining this alignment, lock the wheel into place on the wind tunnel test port. Align the scribe line on the pointer collar with the reference scribe line or with a mark aligned with the reference scribe line, as determined under section 18.1.1.1. Maintaining this rotational alignment, lock the pointer device onto the probe sheath.

18.4.2.2 Zero the pressure-measuring device used for yaw nulling.

18.4.2.3 Insert the probe assembly into the wind tunnel through the entry port, positioning the probe's impact port at the calibration location. Check the responsiveness of the pressure-measuring device to probe rotation, taking corrective action if the response is unacceptable.

18.4.2.4 Ensure that the probe is in a horizontal position using a carpenter's level.

18.4.2.5 Rotate the probe either clockwise or counterclockwise until a yaw null (P_2=P_3) is obtained.

18.4.2.6 Read and record the value of T_{null}, the angle indicated by the angle-measuring device at the yaw-null position. Record the angle reading on a form similar to Table 2F–6. Do not associate an algebraic sign with this reading.

18.4.2.7 Determine the magnitude and algebraic sign of the reference scribe line rotational offset, R_{SLO}. The magnitude of R_{SLO} will be equal to either T_{null} or $(90° - T_{null})$, depending on the angle-measuring device used. (See Table 2F–7 for a summary.) The algebraic sign of R_{SLO} will either be positive, if the rotational position of the reference scribe line is clockwise, or negative, if counterclockwise with respect to the probe's yaw-null position. Figure 2F–13 illustrates how the magnitude and sign of R_{SLO} are determined.

18.4.2.8 Perform the steps in sections 18.4.2.3 through 18.4.2.7 twice at each of the two calibration velocities selected for the probe under section 10.6. Record the values of R_{SLO} in a form similar to Table 2F–6.

18.4.2.9 The average of all R_{SLO} values is the reference scribe line rotational offset for the probe.

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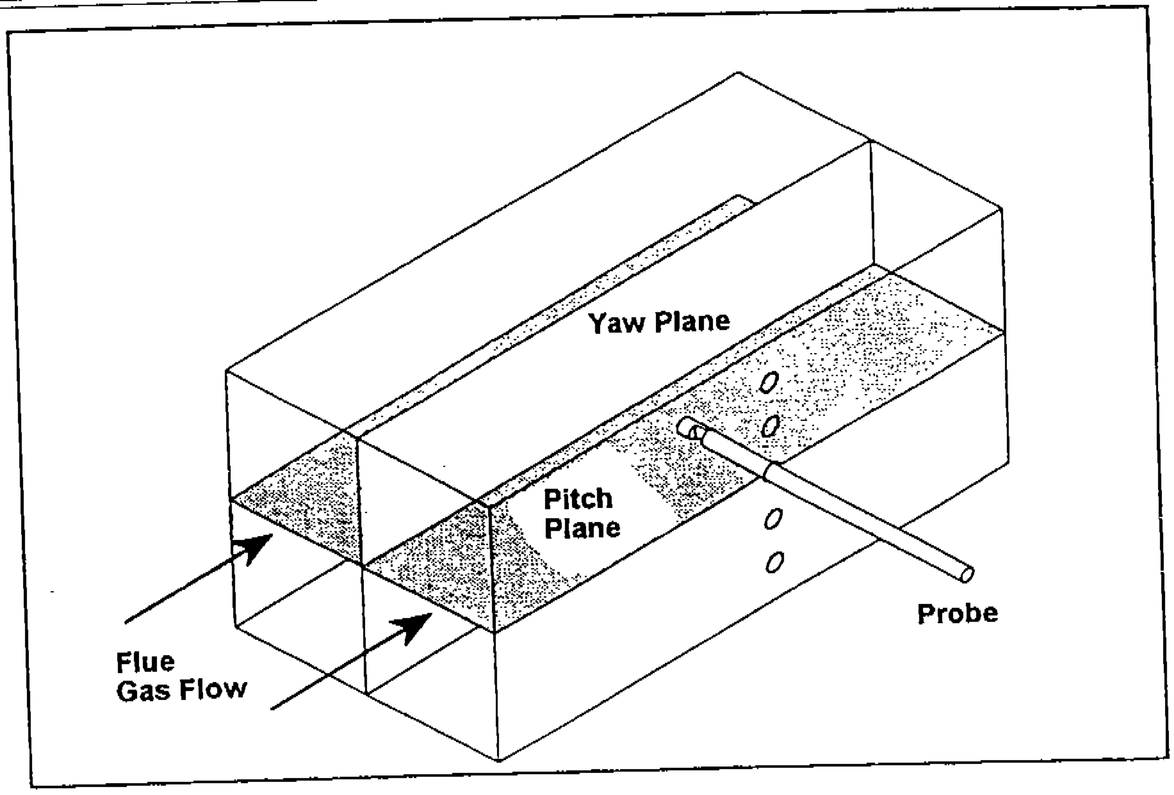


Figure 2F-1. Illustration of yaw and pitch planes in stack or duct.

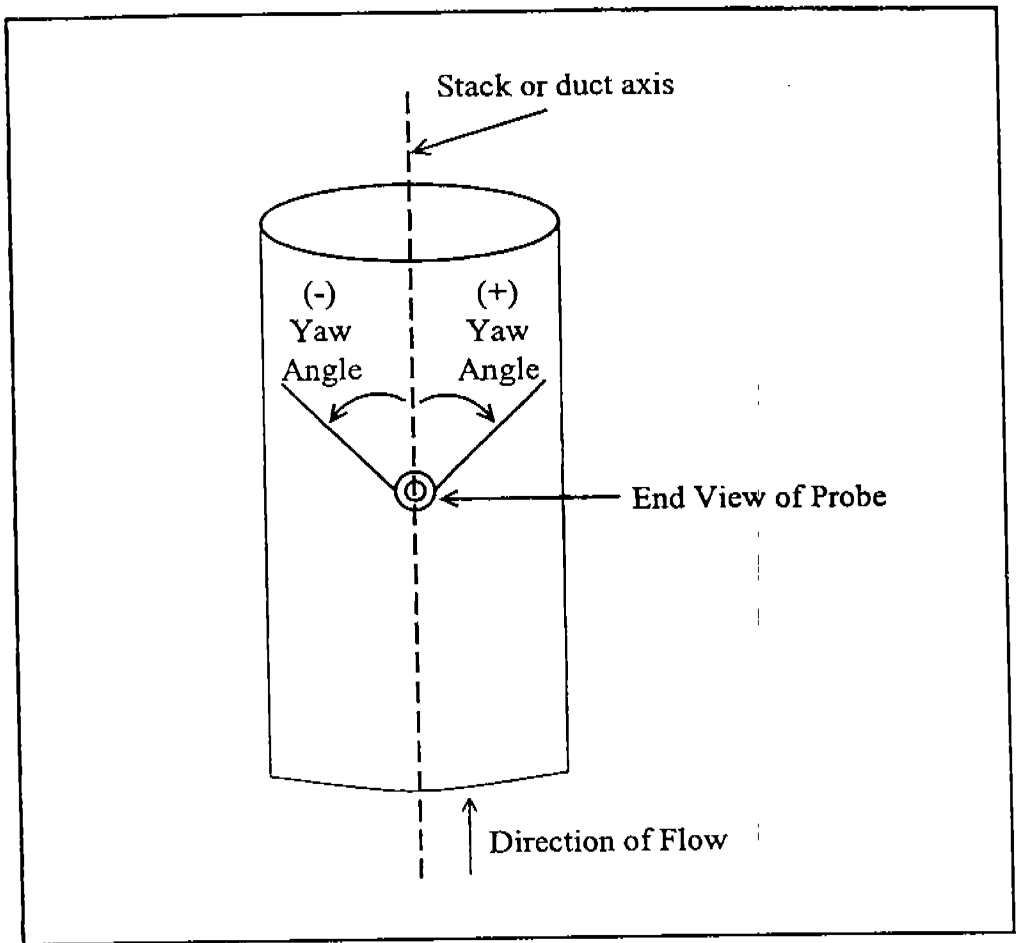


Figure 2F-2. Illustration of probe rotation representing positive and negative yaw angles.

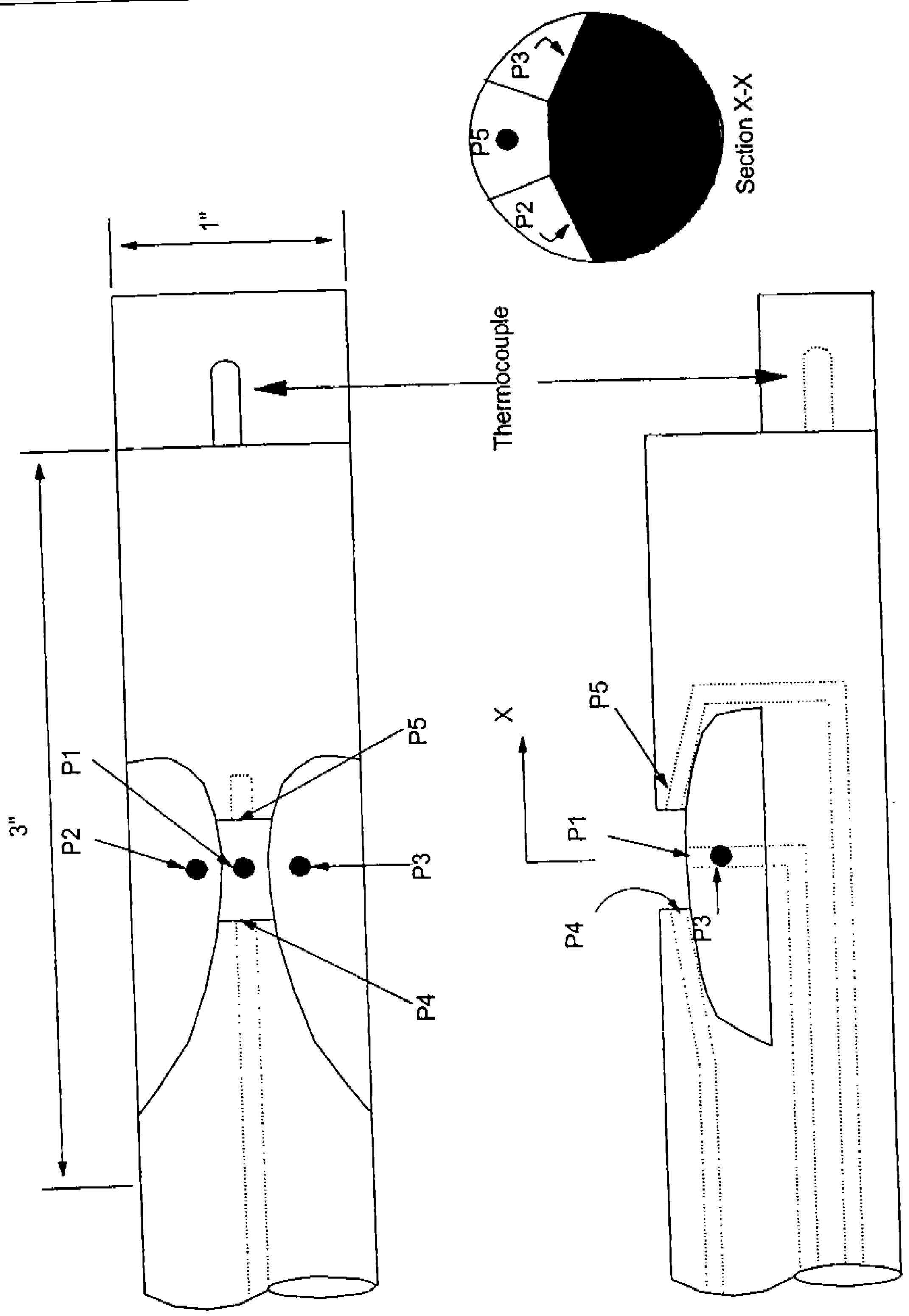


Figure 2F-3. Illustration of a five-hole prism-shaped (DAT) probe.

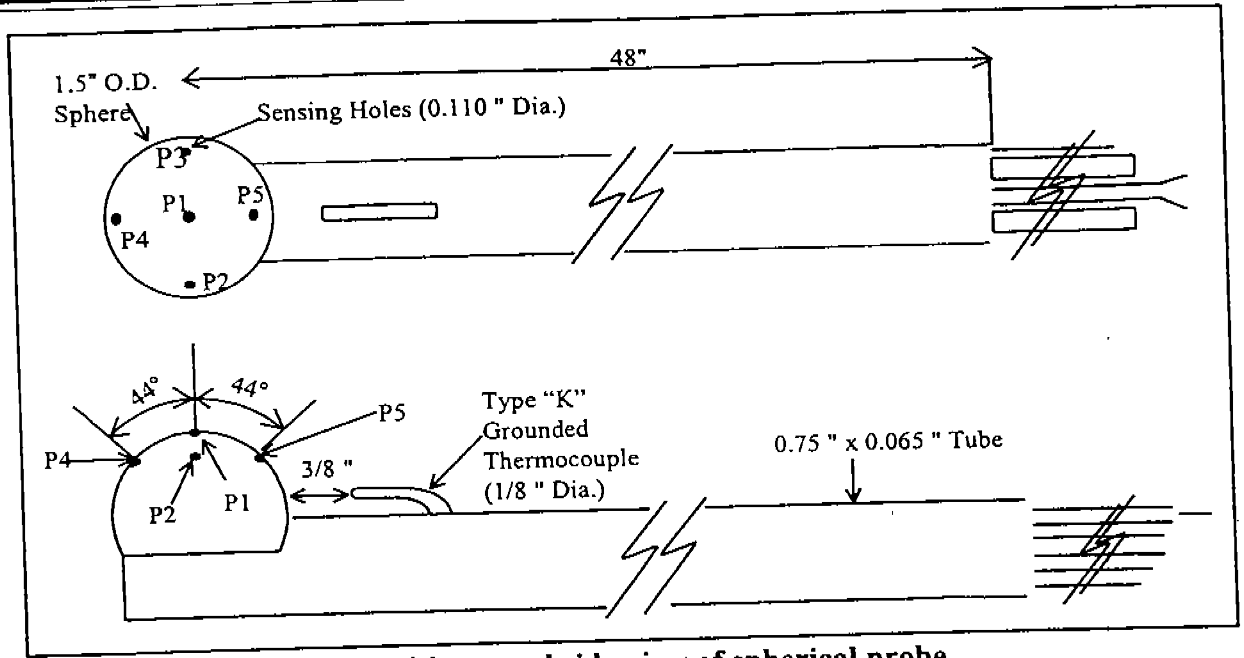


Figure 2F-4. Illustration of front and side view of spherical probe.

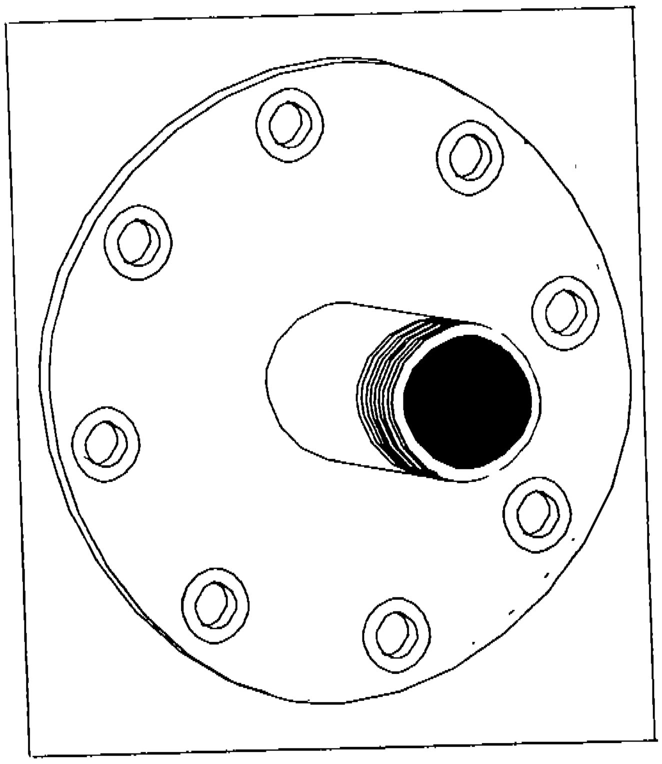


Figure 2F-5. Example bushing sleeve.

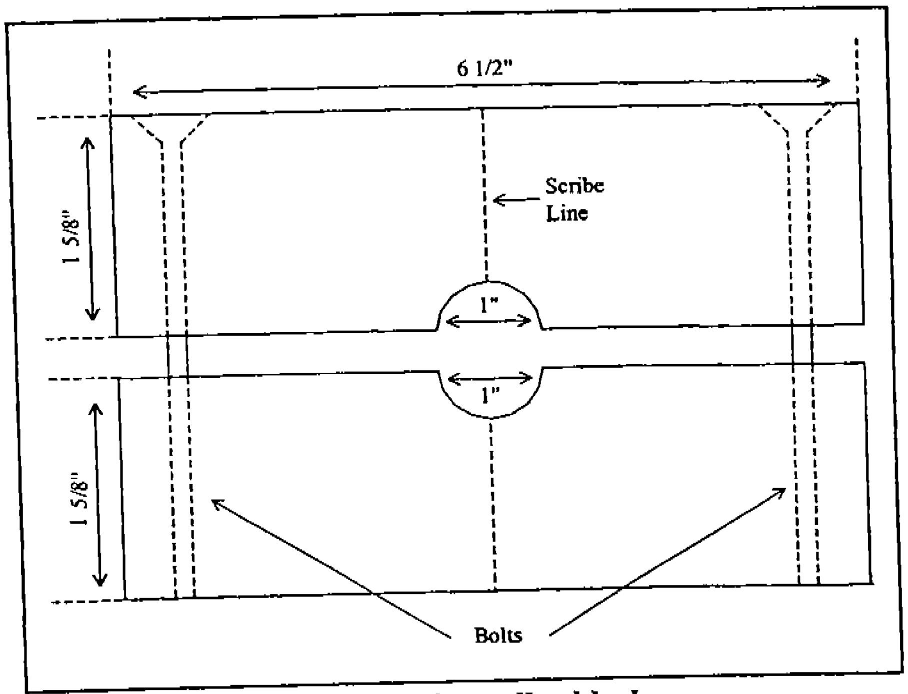


Figure 2F-6. Rotational position collar block.

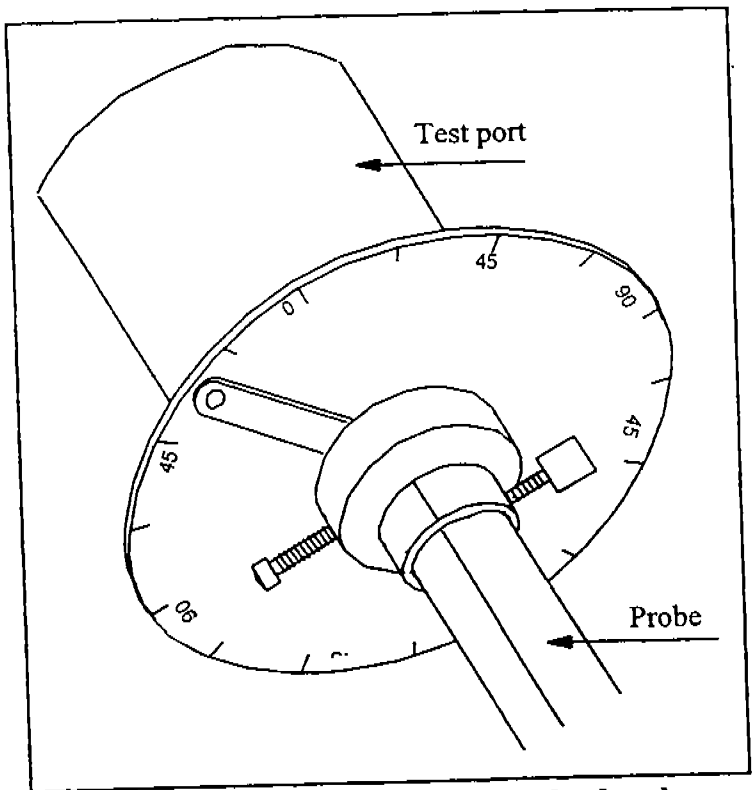


Figure 2F-7. Yaw angle protractor wheel and pointer.

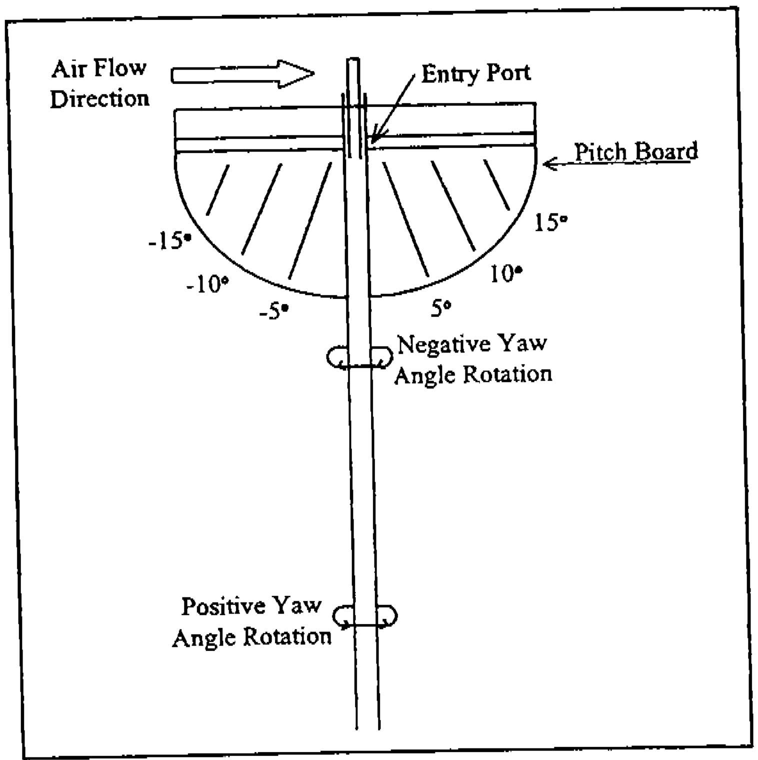


Figure 2F-8. Pitch angle protractor plate.

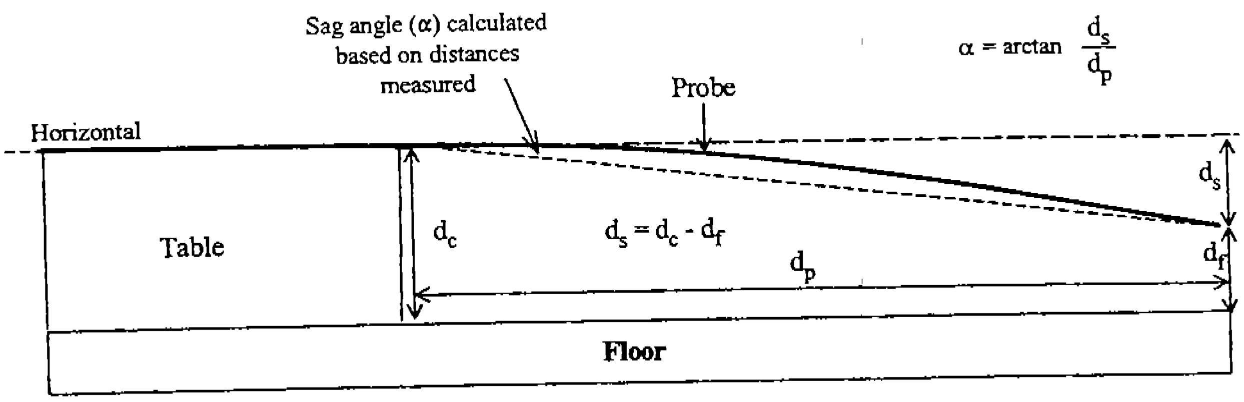


Figure 2F-9. Elements in horizontal straightness test using trigonometry.

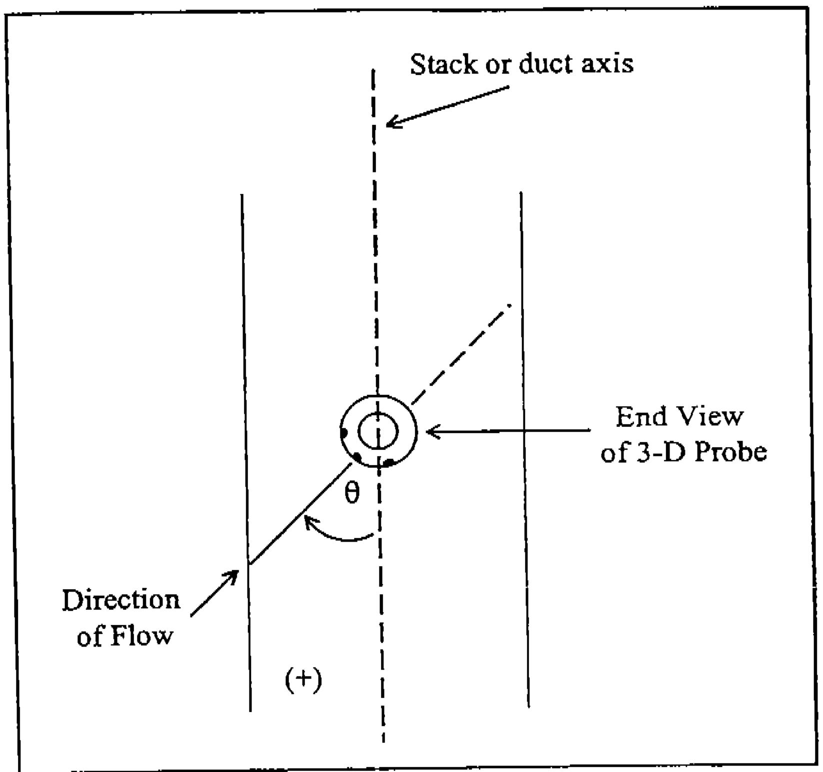


Figure 2F-10. Sign convention for the measured angle (θ) when the probe impact port is pointed directly into the flow. The angle θ is positive when the probe's impact pressure port is oriented in a clockwise rotational position relative to the stack or duct axis, as shown above and negative for a counterclockwise orientation.

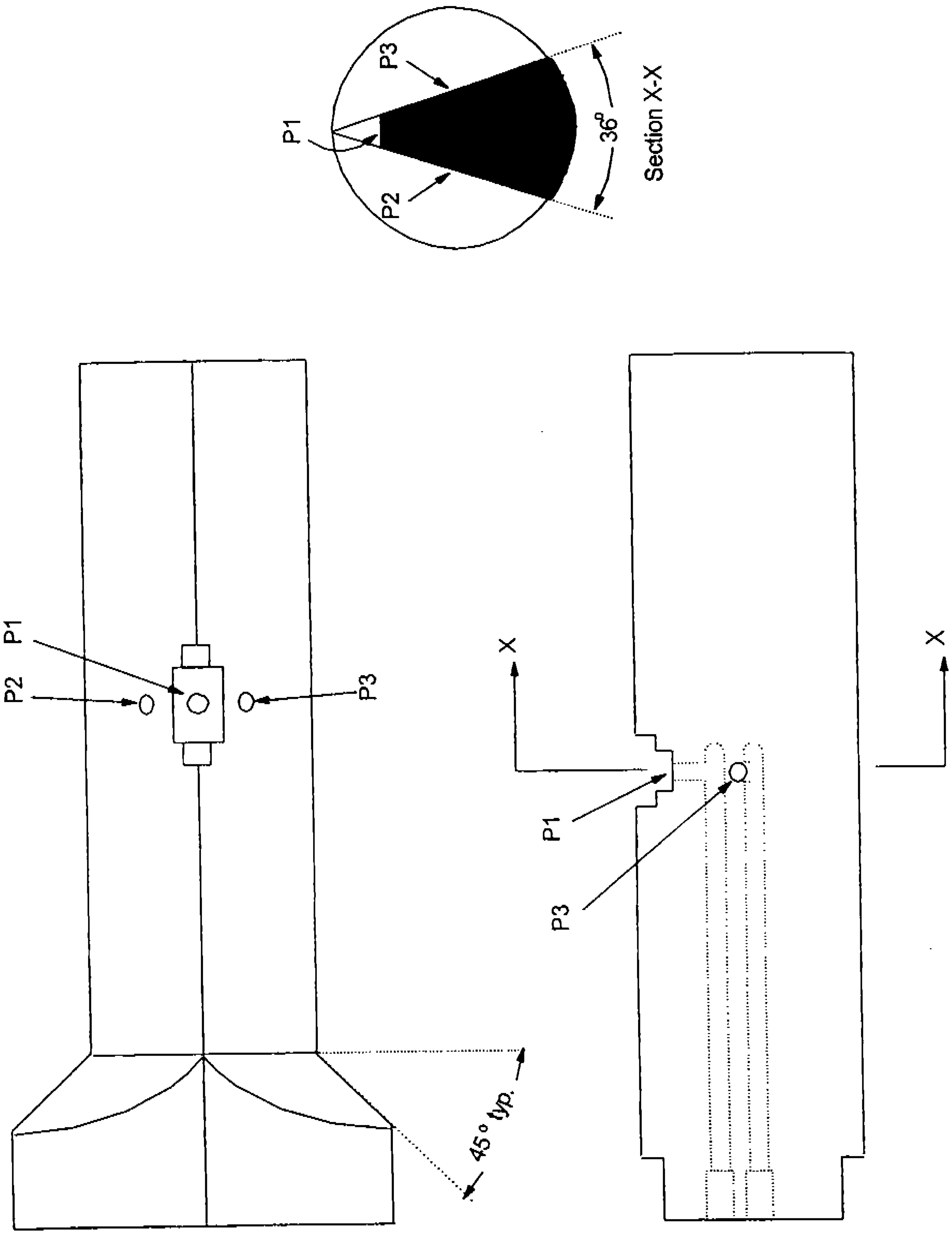


Figure 2F-11. Wedge probe used for axial flow verification.

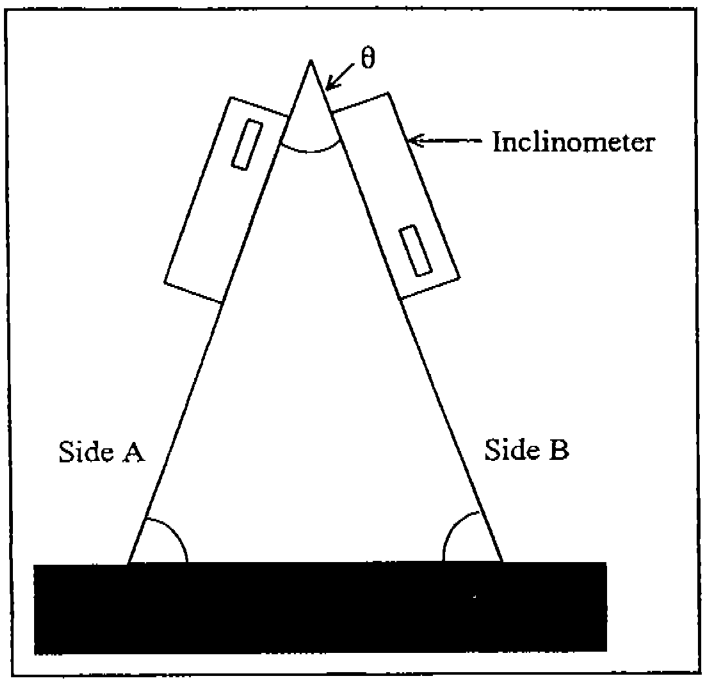


Figure 2F-12. Triangular block used for digital inclinometer calibration.

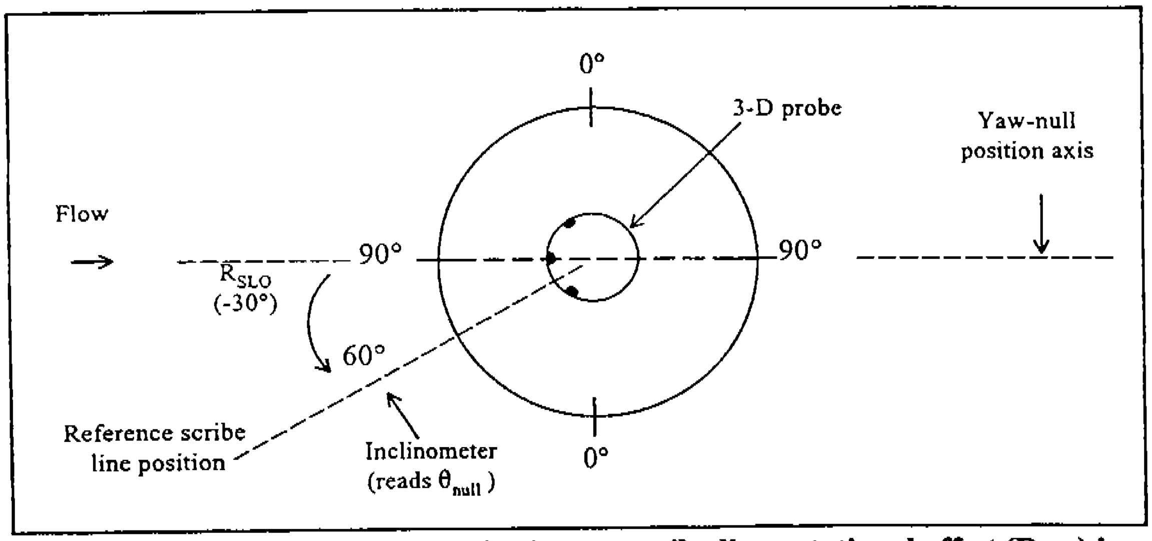


Figure 2F-13. Determination of reference scribe line rotational offset (R_{SLO}) in a horizontal wind tunnel with axial flow for a 3-D probe. The probe impact pressure port is aligned with the yaw-null position and is pointed into the flow. The inclinometer reads θ_{null}. The magnitude of $R_{SLO}=90°-\theta_{null}$ and the sign is a negative (counterclockwise from yaw-null position axis).

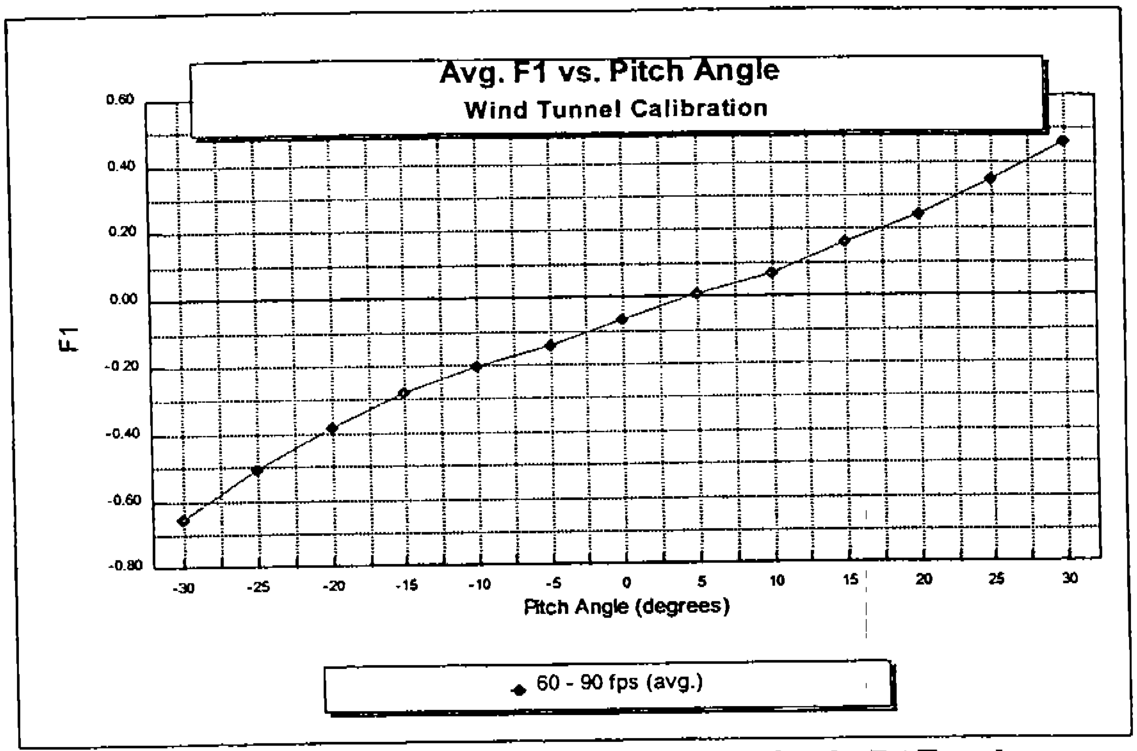


Figure 2F-14. Example F_1 calibration curve for the DAT probe.

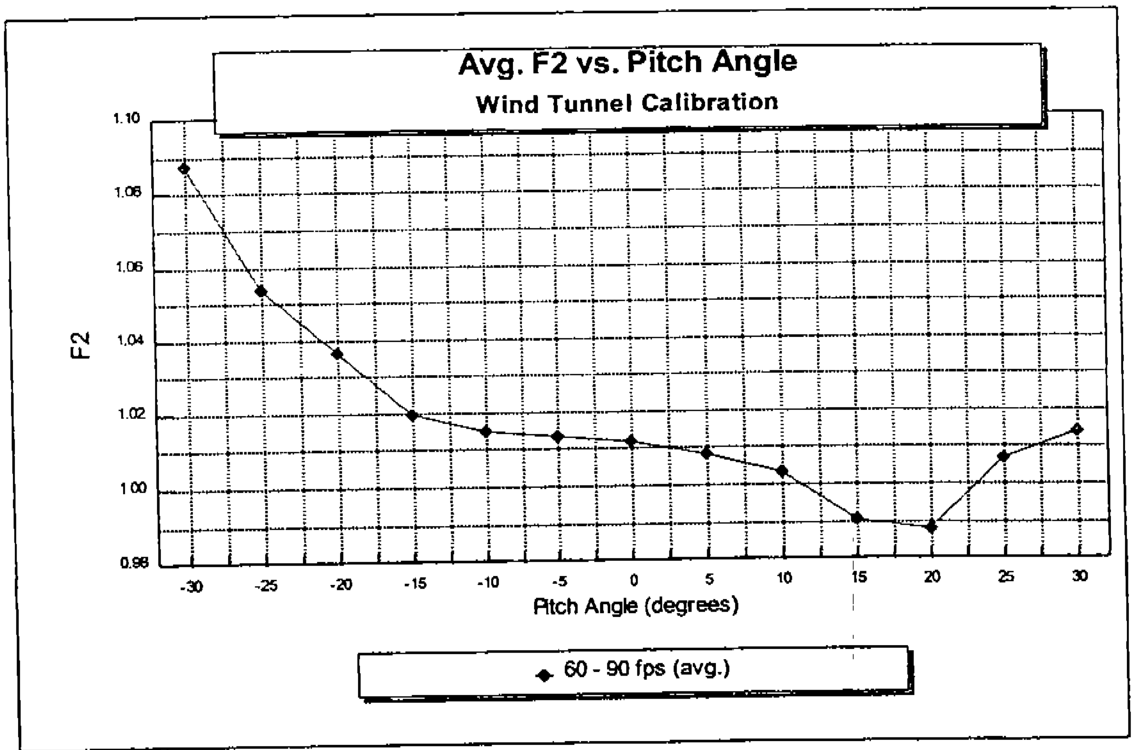


Figure 2F-15. Example F_2 calibration curve for the DAT probe.

Table 2F-1. 3-D Probe Inspection Sheet

Probe Type and ID # ____________ **Date of most recent calibration:** ______________

Fill in the tables below. For any item assigned a value of "1", show its location in the accompanying probe diagrams.

Inspection of Probe Ports

Port ID	Current Inspection (1=present, 0=absent)			Compared to Previous Calibration (1=changed, 0=unchanged)			Brief Description of Any Item with a Value of "1" in Preceding Columns
	Dents	Scratches	Asymmetries	Dents	Scratches	Asymmetries	
P1							
P2							
P3							
P4							
P5							

Inspection of Probe Surfaces

Surface ID	Current Inspection (1=present, 0=absent)		Compared to Previous Calibration (1=changed, 0=unchanged)		Brief Description of Any Item with a Value of "1" in Preceding Columns
	Scratches	Indentations	Scratches	Indentations	
S1					
S2					
S3					
S4					
S5					

Surface IDs S1 through S5 refer to the surfaces adjacent to pressure ports with the corresponding numbers, e.g., S3 refers to the surface adjacent to pressure port P3.

QA/QC Check

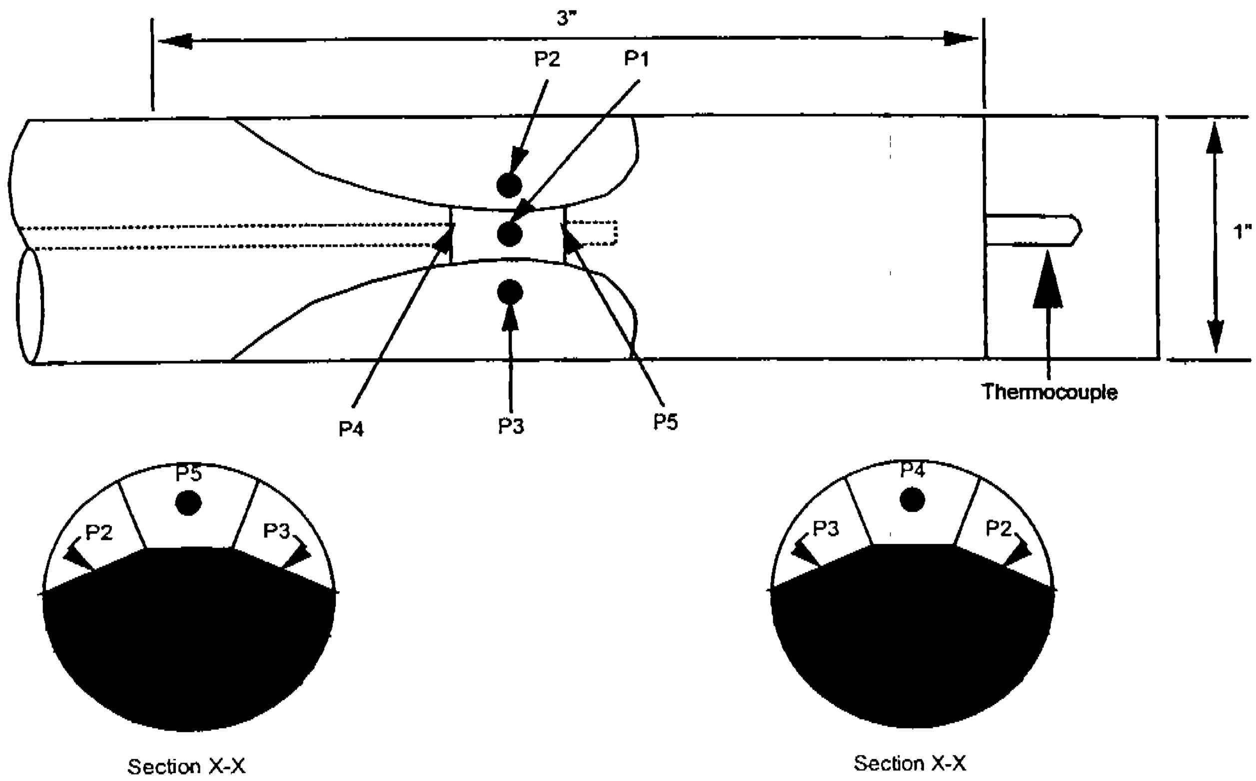
Completeness ___ Legibility ___ Accuracy ___ Specifications ___ Reasonableness ___

Certification

I certify that the Probe ID __________ meets or exceeds all specifications, criteria, and/or applicable design features required under Method 2F.

Certified by: __________________ Date: ________________

Table 2F-1. 3-D Probe Inspection Sheet (continued)



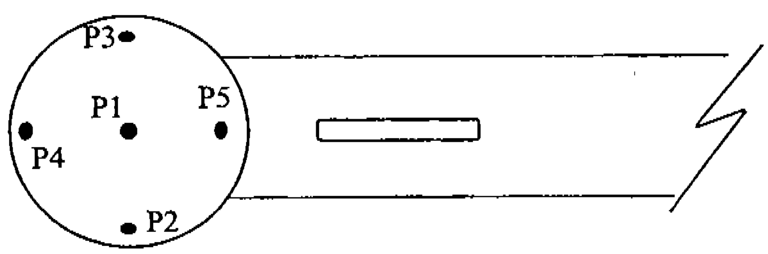


Table 2F-2. Rotational Position Check

Source: ______________________ Date: ______________________

Test Location: ______________________ Tester(s): ______________________

Probe Type: ______________________ Affiliation: ______________________

Probe ID: ______________________ Fully-Assembled Probe Length (in.): ____________

Position	**Angle Comparisons**		
Distance of 2nd measurement device from probe head impact port in mm (in.)	**1st Device** Angle measured by device aligned on the reference scribe line, including algebraic sign (degrees)	**2nd Device** Angle measured by device mounted at each position to be used during testing, including algebraic sign (degrees)	**R_{ADO}** Difference between readings by 1st and 2nd angle-measuring devices (degrees)[a]
(Col. A)	(Col. B)	(Col. C)	(Col. C - Col. B)

[a] The algebraic sign must be consistent with section 8.3.2.

Specifications: For the pre-test rotational position check, the value of R_{ADO} at each location along the probe shaft must be determined to within ±1°. In the post-test check, R_{ADO} at each location must remain within ±2° of the value obtained in the pre-test check.

Table 2F-3. Example EPA Method 2F Field Data Form

Source: ____________ Date: ____________

Source Location: ____________ Test Personnel: ____________

Measurement Location: ____________ Probe Type / ID: ____________

Run ID:	
Start Time:	
End Time:	
Pressure Gauge ID:	
Pressure Gauge Readability:	in. H_2O
Temperature Gauge ID:	
Measurement Response Time:	sec.
R_{SLO}	
R_{ADO}	

Stack Diameter:	
Stack Area:	
Barometric Pressure (P_{bar}):	in. Hg
Static Pressure (P_s):	in. H_2O

	Pre-Test	Post-Test
Probe Head Condition: Damage Noted?		
Leak Check Performed?		

Clock Time	Traverse Point	Yaw Angle, including algebraic sign (degrees)	Velocity Differential Pressure (P_1-P_2)	Pitch Differential Pressure (P_4-P_5)	Stack or Duct Gas Temperature (°F)

Table 2F-4. Wind Tunnel Velocity Pressure Cross-Check

Wind Tunnel Facility: ______________________________
Date: ______________________________
Wind Tunnel Temperature: ______________________________
Barometric Pressure: ______________________________
Test Point Locations: ______________________________
Lowest Test Velocity in m/sec (ft/sec): ______________________________
Highest Test Velocity in m/sec (ft/sec): ______________________________

Port		**Rep.**	**Velocity Pressure (ΔP_{std})**	
			@ Lowest Test Velocity	**@ Highest Test Velocity**
Calibration Pitot Tube Location		1		
		2		
		3		
		Average		
Calibration Location Test Points *	1	1		
		2		
		3		
		Average		
		% Difference **		
	2	1		
		2		
		3		
		Average		
		% Difference **		
		1		
		2		
		3		
		Average		
		% Difference **		

* Measurements must be taken at all points in the calibration location as specified in section 10.1.1

** Percent Difference = $\frac{(\text{Calibration Location Test Point Avg} - \text{Cal. Pitot Tube Location Avg})}{\text{Cal. Pitot Tube Location Avg}} \times 100\%$

Specification: At each velocity setting, the average velocity pressure obtained at the calibration location shall be within ±2 percent or 0.01 in. H_2O, whichever is less restrictive, of the average velocity pressure obtained at the fixed calibration pitot tube location.

Table 2F-5. Wind Tunnel Axial Flow Verification

Wind Tunnel Facility: ______________________
Date: ______________________
Wind Tunnel Temperature: ______________________
Barometric Pressure: ______________________
Probe Type/I.D. Used To Conduct Check: ______________________
Test Point Locations: ______________________
Lowest Test Velocity in m/sec (ft/sec): ______________________
Highest Test Velocity in m/sec (ft/sec): ______________________

Port		@ Lowest Test Velocity		@ Highest Test Velocity	
		Yaw Angle * (degrees)	**Pitch Angle * (degrees)**	**Yaw Angle * (degrees)**	**Pitch Angle * (degrees)**
Calibration Location Test Points **	1				
	2				
	3				
	..				
Calibration Pitot Tube Location					

* When following the procedures in section 10.1.2.1, both the yaw and pitch angles are obtained from the same port. When following the procedures in section 10.1.2.2, the yaw angle is obtained using the port for the tested probe, and the pitch angle is obtained using the port for verification of axial flow.

** Yaw and pitch angle measurements must be taken at all points that define the calibration location (as per the requirements in section 10.1.1)

Specification: At each velocity setting, each measured yaw and pitch angle shall be within ±3° of 0° in accordance with the requirements in section 10.1.2.

Table 2F-6. Yaw Angle Calibration

Probe Type:________________ Tester(s):________________

Probe ID:________________ Affiliation:________________

Test Location:________________ Date:________________

	Repetition 1		Repetition 2	
Nominal Velocity Setting in m/sec (ft/sec)	θ_{null} **(degrees)**	R_{SLO} **(degrees)***	θ_{null} **(degrees)**	R_{SLO} **(degrees)***

Average of all recorded R_{SLO} values: ________

* Include magnitude and algebraic sign in accordance with section 10.5.7.

Table 2F-7. Determining the Magnitude of Reference Scribe Line Offset

Probe/Angle-Measuring Device	Magnitude of R_{SLO}
3-D probe with inclinometer	$90° - \theta_{null}$
3-D probe with protractor wheel and pointer	θ_{null}

Table 2F-8. Wind Tunnel Calibration of Three-Dimensional Probe

Wind Tunnel Facility: ______________________

Wind Tunnel Location: ______________________

Probe Type: ______________________

Probe ID: ______________________

Probe Calibration Date: ______________________

Test Location: ______________________

Calibration Pitot Tube Coeff. (C_p): ______________________

Ambient Temperature (° F): ______________________

Barometric Pressure (P_{bar}): ______________________

		Calibration Pitot Tube		Tested Probe				
Velocity Setting (ft/sec)	Pitch Angle	ΔP_{std} (in. H_2O)*	Temp. (°F)	P_1-P_2 (in. H_2O)	P_4-P_5 (in. H_2O)	Yaw Angle (degrees)	Calc. F_1	Calc. F_2
	-30°							
	-25°							
	-20°							
	-15°							
	-10°							
	-5°							
	0°							
	5°							
	10°							
	15°							
	20°							
	25°							
	30°							

* Calibration pitot tube measurements must, at a minimum, be taken before the tested probe reading at the first pitch angle setting, and after the tested probe reading at the last pitch angle setting in each replicate. See section 10.6.11.

Table 2F-9. Calibration Log for Three-Dimensional Probe

Probe ID: ____________________

Probe Type: ____________________

Probe Calibration Date: ____________________

Test Location: ____________________

Nominal Velocity: ____________________

Pitch Angle	Average of All Repetitions		Number of Repetitions
	F_1	F_2	
-35°			
-30°			
-25°			
-20°			
-15°			
-10°			
-5°			
0°			
5°			
10°			
15°			
20°			
25°			
30°			
35°			

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Method 2G—Determination of Stack Gas Velocity and Volumetric Flow Rate With Two-Dimensional Probes

Note: This method does not include all of the specifications (e.g., equipment and supplies) and procedures (e.g., sampling) essential to its performance. Some material has been incorporated from other methods in this part. Therefore, to obtain reliable results, those using this method should have a thorough knowledge of at least the following additional test methods: Methods 1, 2, 3 or 3A, and 4.

1.0 Scope and Application

1.1 This method is applicable for the determination of yaw angle, near-axial velocity, and the volumetric flow rate of a gas stream in a stack or duct using a two-dimensional (2-D) probe.

2.0 Summary of Method

2.1 A 2-D probe is used to measure the velocity pressure and the yaw angle of the flow velocity vector in a stack or duct. Alternatively, these measurements may be made by operating one of the three-dimensional (3-D) probes described in Method 2F, in yaw determination mode only. From these measurements and a determination of the stack gas density, the average near-axial velocity of the stack gas is calculated. The near-axial velocity accounts for the yaw, but not the pitch, component of flow. The average gas volumetric flow rate in the stack or duct is then determined from the average near-axial velocity.

3.0 Definitions

3.1. *Angle-measuring Device Rotational Offset (R_{ADO}).* The rotational position of an angle-measuring device relative to the reference scribe line, as determined during the pre-test rotational position check described in section 8.3.

3.2 *Calibration Pitot Tube.* The standard (Prandtl type) pitot tube used as a reference when calibrating a probe under this method.

3.3 *Field Test.* A set of measurements conducted at a specific unit or exhaust stack/duct to satisfy the applicable regulation (e.g., a three-run boiler performance test, a single- or multiple-load nine-run relative accuracy test).

3.4 *Full Scale of Pressure-measuring Device.* Full scale refers to the upper limit of the measurement range displayed by the device. For bi-directional pressure gauges, full scale includes the entire pressure range from the lowest negative value to the highest positive value on the pressure scale.

3.5 *Main probe.* Refers to the probe head and that section of probe sheath directly attached to the probe head. The main probe sheath is distinguished from probe extensions, which are sections of sheath added onto the main probe to extend its reach.

3.6 *"May," "Must," "Shall," "Should,"* and the imperative form of verbs.

3.6.1 *"May"* is used to indicate that a provision of this method is optional.

3.6.2 *"Must," "Shall,"* and the imperative form of verbs (such as "record" or "enter") are used to indicate that a provision of this method is mandatory.

3.6.3 *"Should"* is used to indicate that a provision of this method is not mandatory, but is highly recommended as good practice.

3.7 *Method 1.* Refers to 40 CFR part 60, appendix A, "Method 1—Sample and velocity traverses for stationary sources."

3.8 *Method 2.* Refers to 40 CFR part 60, appendix A, "Method 2—Determination of stack gas velocity and volumetric flow rate (Type S pitot tube)."

3.9 *Method 2F.* Refers to 40 CFR part 60, appendix A, "Method 2F—Determination of stack gas velocity and volumetric flow rate with three-dimensional probes."

3.10 *Near-axial Velocity.* The velocity vector parallel to the axis of the stack or duct that accounts for the yaw angle component of gas flow. The term "near-axial" is used herein to indicate that the velocity and volumetric flow rate results account for the measured yaw angle component of flow at each measurement point.

3.11 *Nominal Velocity.* Refers to a wind tunnel velocity setting that approximates the actual wind tunnel velocity to within ±1.5 m/sec (±5 ft/sec).

3.12 *Pitch Angle.* The angle between the axis of the stack or duct and the pitch component of flow, i.e., the component of the total velocity vector in a plane defined by the traverse line and the axis of the stack or duct. (Figure 2G-1 illustrates the "pitch plane.") From the standpoint of a tester facing a test port in a vertical stack, the pitch component of flow is the vector of flow moving from the center of the stack toward or away from that test port. The pitch angle is the angle described by this pitch component of flow and the vertical axis of the stack.

3.13 *Readability.* For the purposes of this method, readability for an analog measurement device is one half of the smallest scale division. For a digital measurement device, it is the number of decimals displayed by the device.

3.14 *Reference Scribe Line.* A line permanently inscribed on the main probe sheath (in accordance with section 6.1.5.1) to serve as a reference mark for determining yaw angles.

3.15 *Reference Scribe Line Rotational Offset (R_{SLO}).* The rotational position of a probe's reference scribe line relative to the probe's yaw-null position, as determined during the yaw angle calibration described in section 10.5.

3.16 *Response Time.* The time required for the measurement system to fully respond to a change from zero differential pressure and ambient temperature to the stable stack or duct pressure and temperature readings at a traverse point.

3.17 *Tested Probe.* A probe that is being calibrated.

3.18 *Three-dimensional (3-D) Probe.* A directional probe used to determine the velocity pressure and the yaw and pitch angles in a flowing gas stream.

3.19 *Two-dimensional (2-D) Probe.* A directional probe used to measure velocity pressure and yaw angle in a flowing gas stream.

3.20 *Traverse Line.* A diameter or axis extending across a stack or duct on which measurements of velocity pressure and flow angles are made.

3.21 *Wind Tunnel Calibration Location.* A point, line, area, or volume within the wind tunnel test section at, along, or within which probes are calibrated. At a particular wind tunnel velocity setting, the average velocity pressures at specified points at, along, or within the calibration location shall vary by no more than 2 percent or 0.3 mm H_2O (0.01 in. H_2O), whichever is less restrictive, from the average velocity pressure at the calibration pitot tube location. Air flow at this location shall be axial, i.e., yaw and pitch angles within ±3 of 0. Compliance with these flow criteria shall be demonstrated by performing the procedures prescribed in sections 10.1.1 and 10.1.2. For circular tunnels, no part of the calibration location may be closer to the tunnel wall than 10.2 cm (4 in.) or 25 percent of the tunnel diameter, whichever is farther from the wall. For elliptical or rectangular tunnels, no part of the calibration location may be closer to the tunnel wall than 10.2 cm (4 in.) or 25 percent of the applicable cross-sectional axis, whichever is farther from the wall.

3.22 *Wind Tunnel with Documented Axial Flow.* A wind tunnel facility documented as meeting the provisions of sections 10.1.1 (velocity pressure cross-check) and 10.1.2 (axial flow verification) using the procedures described in these sections or alternative procedures determined to be technically equivalent.

3.23 *Yaw Angle.* The angle between the axis of the stack or duct and the yaw component of flow, i.e., the component of the total velocity vector in a plane perpendicular to the traverse line at a particular traverse point. (Figure 2G-1 illustrates the "yaw plane.") From the standpoint of a tester facing a test port in a vertical stack, the yaw component of flow is the vector of flow moving to the left or right from the center of the stack as viewed by the tester. (This is sometimes referred to as "vortex flow," i.e., flow around the centerline of a stack or duct.) The yaw angle is the angle described by this yaw component of flow and the vertical axis of the stack. The algebraic sign convention is illustrated in Figure 2G-2.

3.24 *Yaw Nulling.* A procedure in which a Type-S pitot tube or a 3-D probe is rotated about its axis in a stack or duct until a zero differential pressure reading ("yaw null") is obtained. When a Type S probe is yaw-nulled, the rotational position of its impact port is 90° from the direction of flow in the stack or duct and the Δ P reading is zero. When a 3-D probe is yaw-nulled, its impact pressure port (P_1) faces directly into the direction of flow in the stack or duct and the differential pressure between pressure ports P_2 and P_3 is zero.

4.0 Interferences. [Reserved]

5.0 Safety

5.1 This test method may involve hazardous operations and the use of hazardous materials or equipment. This method does not purport to address all of the safety problems associated with its use. It is the responsibility of the user to establish and implement appropriate safety and health practices and to determine the applicability of regulatory limitations before using this test method.

6.0 Equipment and Supplies

6.1 Two-dimensional Probes. Probes that provide both the velocity pressure and the yaw angle of the flow vector in a stack or duct, as listed in sections 6.1.1 and 6.1.2, qualify for use based on comprehensive wind tunnel and field studies involving both inter- and intra-probe comparisons by multiple test teams. Each 2–D probe shall have a unique identification number or code permanently marked on the main probe sheath. Each probe shall be calibrated prior to use according to the procedures in section 10. Manufacturer-supplied calibration data shall be used as example information only, except when the manufacturer calibrates the probe as specified in section 10 and provides complete documentation.

6.1.1 Type S (Stausscheibe or reverse type) pitot tube. This is the same as specified in Method 2, section 2.1, except for the following additional specifications that enable the pitot tube to accurately determine the yaw component of flow. For the purposes of this method, the external diameter of the tubing used to construct the Type S pitot tube (dimension D_t in Figure 2–2 of Method 2) shall be no less than 9.5 mm (3/8 in.). The pitot tube shall also meet the following alignment specifications. The angles α_1, α_2, β_1, and β_2, as shown in Method 2, Figure 2–3, shall not exceed ±2°. The dimensions w and z, shown in Method 2, Figure 2–3 shall not exceed 0.5 mm (0.02 in.).

6.1.1.1 Manual Type S probe. This refers to a Type S probe that is positioned at individual traverse points and yaw nulled manually by an operator.

6.1.1.2 Automated Type S probe. This refers to a system that uses a computer-controlled motorized mechanism to position the Type S pitot head at individual traverse points and perform yaw angle determinations.

6.1.2 Three-dimensional probes used in 2–D mode. A 3–D probe, as specified in sections 6.1.1 through 6.1.3 of Method 2F, may, for the purposes of this method, be used in a two-dimensional mode (i.e., measuring yaw angle, but not pitch angle). When the 3–D probe is used as a 2–D probe, only the velocity pressure and yaw-null pressure are obtained using the pressure taps referred to as P_1, P_2, and P_3. The differential pressure P_1–P_2 is a function of total velocity and corresponds to the Δ P obtained using the Type S probe. The differential pressure P_2–P_3 is used to yaw null the probe and determine the yaw angle. The differential pressure P_4–P_5, which is a function of pitch angle, is not measured when the 3–D probe is used in 2–D mode.

6.1.3 Other probes. [Reserved]

6.1.4 Probe sheath. The probe shaft shall include an outer sheath to: (1) provide a surface for inscribing a permanent reference scribe line, (2) accommodate attachment of an angle-measuring device to the probe shaft, and (3) facilitate precise rotational movement of the probe for determining yaw angles. The sheath shall be rigidly attached to the probe assembly and shall enclose all pressure lines from the probe head to the farthest position away from the probe head where an angle-measuring device may be attached during use in the field. The sheath of the fully assembled probe shall be sufficiently rigid and straight at all rotational positions such that, when one end of the probe shaft is held in a horizontal position, the fully extended probe meets the horizontal straightness specifications indicated in section 8.2 below.

6.1.5 Scribe lines.

6.1.5.1 Reference scribe line. A permanent line, no greater than 1.6 mm (1/16 in.) in width, shall be inscribed on each manual probe that will be used to determine yaw angles of flow. This line shall be placed on the main probe sheath in accordance with the procedures described in section 10.4 and is used as a reference position for installation of the yaw angle-measuring device on the probe. At the discretion of the tester, the scribe line may be a single line segment placed at a particular position on the probe sheath (e.g., near the probe head), multiple line segments placed at various locations along the length of the probe sheath (e.g., at every position where a yaw angle-measuring device may be mounted), or a single continuous line extending along the full length of the probe sheath.

6.1.5.2 Scribe line on probe extensions. A permanent line may also be inscribed on any probe extension that will be attached to the main probe in performing field testing. This allows a yaw angle-measuring device mounted on the extension to be readily aligned with the reference scribe line on the main probe sheath.

6.1.5.3 Alignment specifications. This specification shall be met separately, using the procedures in section 10.4.1, on the main probe and on each probe extension. The rotational position of the scribe line or scribe line segments on the main probe or any probe extension must not vary by more than 2°. That is, the difference between the minimum and maximum of all of the rotational angles that are measured along the full length of the main probe or the probe extension must not exceed 2°.

6.1.6 Probe and system characteristics to ensure horizontal stability.

6.1.6.1 For manual probes, it is recommended that the effective length of the probe (coupled with a probe extension, if necessary) be at least 0.9 m (3 ft.) longer than the farthest traverse point mark on the probe shaft away from the probe head. The operator should maintain the probe's horizontal stability when it is fully inserted into the stack or duct. If a shorter probe is used, the probe should be inserted through a bushing sleeve, similar to the one shown in Figure 2G–3, that is installed on the test port; such a bushing shall fit snugly around the probe and be secured to the stack or duct entry port in such a manner as to maintain the probe's horizontal stability when fully inserted into the stack or duct.

6.1.6.2 An automated system that includes an external probe casing with a transport system shall have a mechanism for maintaining horizontal stability comparable to that obtained by manual probes following the provisions of this method. The automated probe assembly shall also be constructed to maintain the alignment and position of the pressure ports during sampling at each traverse point. The design of the probe casing and transport system shall allow the probe to be removed from the stack or duct and checked through direct physical measurement for angular position and insertion depth.

6.1.7 The tubing that is used to connect the probe and the pressure-measuring device should have an inside diameter of at least 3.2 mm (1/8 in.), to reduce the time required for pressure equilibration, and should be as short as practicable.

6.1.8 If a detachable probe head without a sheath [e.g., a pitot tube, typically 15.2 to 30.5 cm (6 to 12 in.) in length] is coupled with a probe sheath and calibrated in a wind tunnel in accordance with the yaw angle calibration procedure in section 10.5, the probe head shall remain attached to the probe sheath during field testing in the same configuration and orientation as calibrated. Once the detachable probe head is uncoupled or re-oriented, the yaw angle calibration of the probe is no longer valid and must be repeated before using the probe in subsequent field tests.

6.2 Yaw Angle-measuring Device. One of the following devices shall be used for measurement of the yaw angle of flow.

6.2.1 Digital inclinometer. This refers to a digital device capable of measuring and displaying the rotational position of the probe to within ±1°. The device shall be able to be locked into position on the probe sheath or probe extension, so that it indicates the probe's rotational position throughout the test. A rotational position collar block that can be attached to the probe sheath (similar to the collar shown in Figure 2G–4) may be required to lock the digital inclinometer into position on the probe sheath.

6.2.2 Protractor wheel and pointer assembly. This apparatus, similar to that shown in Figure 2G–5, consists of the following components.

6.2.2.1 A protractor wheel that can be attached to a port opening and set in a fixed rotational position to indicate the yaw angle position of the probe's scribe line relative to the longitudinal axis of the stack or duct. The protractor wheel must have a measurement ring on its face that is no less than 17.8 cm (7 in.) in diameter, shall be able to be rotated to any angle and then locked into position on the stack or duct test port, and shall indicate angles to a resolution of 1°.

6.2.2.2 A pointer assembly that includes an indicator needle mounted on a collar that can slide over the probe sheath and be locked into a fixed rotational position on the probe sheath. The pointer needle shall be of sufficient length, rigidity, and sharpness to allow the tester to determine the probe's angular position to within 1° from the markings on the protractor wheel. Corresponding to the position of the pointer, the collar must have a scribe line to be used in aligning the pointer with the scribe line on the probe sheath.

6.2.3 Other yaw angle-measuring devices. Other angle-measuring devices with a manufacturer's specified precision of 1° or better may be used, if approved by the Administrator.

6.3 Probe Supports and Stabilization Devices. When probes are used for determining flow angles, the probe head should be kept in a stable horizontal position. For probes longer than 3.0 m (10 ft.), the section of the probe that extends outside the test port shall be secured. Three alternative devices are suggested for maintaining the horizontal position and stability of the probe shaft during flow angle determinations and velocity pressure measurements: (1) monorails installed above each port, (2) probe stands on which the probe shaft may be rested, or (3) bushing sleeves of sufficient length secured to the test ports to maintain probes in a horizontal position. Comparable provisions shall be made to ensure that automated systems maintain the horizontal position of the probe in the stack or duct. The physical characteristics of each test platform may dictate the most suitable type of stabilization device. Thus, the choice of a specific stabilization device is left to the judgement of the testers.

6.4 Differential Pressure Gauges. The velocity pressure (Δ P) measuring devices used during wind tunnel calibrations and field testing shall be either electronic manometers (e.g., pressure transducers), fluid manometers, or mechanical pressure gauges (e.g., Magnehelic® gauges). Use of electronic manometers is recommended. Under low velocity conditions, use of electronic manometers may be necessary to obtain acceptable measurements.

6.4.1 Differential pressure-measuring device. This refers to a device capable of measuring pressure differentials and having a readability of ±1 percent of full scale. The device shall be capable of accurately measuring the maximum expected pressure differential. Such devices are used to determine the following pressure measurements: velocity pressure, static pressure, and yaw-null pressure. For an inclined-vertical manometer, the readability specification of ±1 percent shall be met separately using the respective full-scale upper limits of the inclined and vertical portions of the scales. To the extent practicable, the device shall be selected such that most of the pressure readings are between 10 and 90 percent of the device's full-scale measurement range (as defined in section 3.4). In addition, pressure-measuring devices should be selected such that the zero does not drift by more than 5 percent of the average expected pressure readings to be encountered during the field test. This is particularly important under low pressure conditions.

6.4.2 Gauge used for yaw nulling. The differential pressure-measuring device chosen for yaw nulling the probe during the wind tunnel calibrations and field testing shall be bi-directional, i.e., capable of reading both positive and negative differential pressures. If a mechanical, bi-directional pressure gauge is chosen, it shall have a full-scale range no greater than 2.6 cm (i.e., −1.3 to +1.3 cm) [1 in. H_2O (i.e., −0.5 in. to +0.5 in.)].

6.4.3 Devices for calibrating differential pressure-measuring devices. A precision manometer (e.g., a U-tube, inclined, or inclined-vertical manometer, or micromanometer) or NIST (National Institute of Standards and Technology) traceable pressure source shall be used for calibrating differential pressure-measuring devices. The device shall be maintained under laboratory conditions or in a similar protected environment (e.g., a climate-controlled trailer). It shall not be used in field tests. The precision manometer shall have a scale gradation of 0.3 mm H_2O (0.01 in. H_2O), or less, in the range of 0 to 5.1 cm H_2O (0 to 2 in. H_2O) and 2.5 mm H_2O (0.1 in. H_2O), or less, in the range of 5.1 to 25.4 cm H_2O (2 to 10 in. H_2O). The manometer shall have manufacturer's documentation that it meets an accuracy specification of at least 0.5 percent of full scale. The NIST-traceable pressure source shall be recertified annually.

6.4.4 Devices used for post-test calibration check. A precision manometer meeting the specifications in section 6.4.3, a pressure-measuring device or pressure source with a documented calibration traceable to NIST, or an equivalent device approved by the Administrator shall be used for the post-test calibration check. The pressure-measuring device shall have a readability equivalent to or greater than the tested device. The pressure source shall be capable of generating pressures between 50 and 90 percent of the range of the tested device and known to within ±1 percent of the full scale of the tested device. The pressure source shall be recertified annually.

6.5 Data Display and Capture Devices. Electronic manometers (if used) shall be coupled with a data display device (such as a digital panel meter, personal computer display, or strip chart) that allows the tester to observe and validate the pressure measurements taken during testing. They shall also be connected to a data recorder (such as a data logger or a personal computer with data capture software) that has the ability to compute and retain the appropriate average value at each traverse point, identified by collection time and traverse point.

6.6 Temperature Gauges. For field tests, a thermocouple or resistance temperature detector (RTD) capable of measuring temperature to within ±3°C (±5°F) of the stack or duct temperature shall be used. The thermocouple shall be attached to the probe such that the sensor tip does not touch any metal. The position of the thermocouple relative to the pressure port face openings shall be in the same configuration as used for the probe calibrations in the wind tunnel. Temperature gauges used for wind tunnel calibrations shall be capable of measuring temperature to within ±0.6°C (±1°F) of the temperature of the flowing gas stream in the wind tunnel.

6.7 Stack or Duct Static Pressure Measurement. The pressure-measuring device used with the probe shall be as specified in section 6.4 of this method. The static tap of a standard (Prandtl type) pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may be used for this measurement. Also acceptable is the pressure differential reading of P_1-P_{bar} from a five-hole prism-shaped 3-D probe, as specified in section 6.1.1 of Method 2F (such as the Type DA or DAT probe), with the P_1 pressure port face opening positioned parallel to the gas flow in the same manner as the Type S probe. However, the 3-D spherical probe, as specified in section 6.1.2 of Method 2F, is unable to provide this measurement and shall not be used to take static pressure measurements. Static pressure measurement is further described in section 8.11.

6.8 Barometer. Same as Method 2, section 2.5.

6.9 Gas Density Determination Equipment. Method 3 or 3A shall be used to determine the dry molecular weight of the stack or duct gas. Method 4 shall be used for moisture content determination and computation of stack or duct gas wet molecular weight. Other methods may be used, if approved by the Administrator.

6.10 Calibration Pitot Tube. Same as Method 2, section 2.7.

6.11 Wind Tunnel for Probe Calibration. Wind tunnels used to calibrate velocity probes must meet the following design specifications.

6.11.1 Test section cross-sectional area. The flowing gas stream shall be confined within a circular, rectangular, or elliptical duct. The cross-sectional area of the tunnel must be large enough to ensure fully developed flow in the presence of both the calibration pitot tube and the tested probe. The calibration site, or "test section," of the wind tunnel shall have a minimum diameter of 30.5 cm (12 in.) for circular or elliptical duct cross-sections or a minimum width of 30.5 cm (12 in.) on the shorter side for rectangular cross-sections. Wind tunnels shall meet the probe blockage provisions of this section and the qualification requirements prescribed in section 10.1. The projected area of the portion of the probe head, shaft, and attached devices inside the wind tunnel during calibration shall represent no more than 4 percent of the cross-sectional area of the tunnel. The projected area shall include the combined area of the calibration pitot tube and the tested probe if both probes are placed simultaneously in the same cross-sectional plane in the wind tunnel, or the larger projected area of the two probes if they are placed alternately in the wind tunnel.

6.11.2 Velocity range and stability. The wind tunnel should be capable of maintaining velocities between 6.1 m/sec and 30.5 m/sec (20 ft/sec and 100 ft/sec). The wind tunnel shall produce fully developed flow patterns that are stable and parallel to the axis of the duct in the test section.

6.11.3 Flow profile at the calibration location. The wind tunnel shall provide axial flow within the test section calibration location (as defined in section 3.21). Yaw and pitch angles in the calibration location shall be within ±3° of 0°. The procedure for determining that this requirement has been met is described in section 10.1.2.

6.11.4 Entry ports in the wind tunnel test section.

6.11.4.1 Port for tested probe. A port shall be constructed for the tested probe. This port shall be located to allow the head of the tested probe to be positioned within the wind tunnel calibration location (as defined in section 3.21). The tested probe shall be able to be locked into the 0° pitch angle position. To facilitate alignment of the probe during calibration, the test section should include a window constructed of a transparent material to allow the tested probe to be viewed.

6.11.4.2 Port for verification of axial flow. Depending on the equipment selected to conduct the axial flow verification prescribed in section 10.1.2, a second port, located 90° from the entry port for the tested probe, may be needed to allow verification that the gas flow is parallel to the central axis of the test section. This port should be located and constructed so as to allow one of the probes described in section 10.1.2.2 to access the same test point(s) that are accessible from the port described in section 6.11.4.1.

6.11.4.3 Port for calibration pitot tube. The calibration pitot tube shall be used in the port for the tested probe or in a separate entry port. In either case, all measurements with the calibration pitot tube shall be made at the same point within the wind tunnel over the course of a probe calibration. The measurement point for the calibration pitot tube shall meet the same specifications for distance from the wall and for axial flow as described in section 3.21 for the wind tunnel calibration location.

7.0 *Reagents and Standards.* [Reserved]

8.0 *Sample Collection and Analysis*

8.1 Equipment Inspection and Set Up

8.1.1 All 2–D and 3–D probes, differential pressure-measuring devices, yaw angle-measuring devices, thermocouples, and barometers shall have a current, valid calibration before being used in a field test. (See sections 10.3.3, 10.3.4, and 10.5 through 10.10 for the applicable calibration requirements.)

8.1.2 Before each field use of a Type S probe, perform a visual inspection to verify the physical condition of the pitot tube. Record the results of the inspection. If the face openings are noticeably misaligned or there is visible damage to the face openings, the probe shall not be used until repaired, the dimensional specifications verified (according to the procedures in section 10.2.1), and the probe recalibrated.

8.1.3 Before each field use of a 3–D probe, perform a visual inspection to verify the physical condition of the probe head according to the procedures in section 10.2 of Method 2F. Record the inspection results on a form similar to Table 2F–1 presented in Method 2F. If there is visible damage to the 3–D probe, the probe shall not be used until it is recalibrated.

8.1.4 After verifying that the physical condition of the probe head is acceptable, set up the apparatus using lengths of flexible tubing that are as short as practicable. Surge tanks installed between the probe and pressure-measuring device may be used to dampen pressure fluctuations provided that an adequate measurement system response time (see section 8.8) is maintained.

8.2 Horizontal Straightness Check. A horizontal straightness check shall be performed before the start of each field test, except as otherwise specified in this section. Secure the fully assembled probe (including the probe head and all probe shaft extensions) in a horizontal position using a stationary support at a point along the probe shaft approximating the location of the stack or duct entry port when the probe is sampling at the farthest traverse point from the stack or duct wall. The probe shall be rotated to detect bends. Use an angle-measuring device or trigonometry to determine the bend or sag between the probe head and the secured end. (See Figure 2G–6.) Probes that are bent or sag by more than 5° shall not be used. Although this check does not apply when the probe is used for a vertical traverse, care should be taken to avoid the use of bent probes when conducting vertical traverses. If the probe is constructed of a rigid steel material and consists of a main probe without probe extensions, this check need only be performed before the initial field use of the probe, when the probe is recalibrated, when a change is made to the design or material of the probe assembly, and when the probe becomes bent. With such probes, a visual inspection shall be made of the fully assembled probe before each field test to determine if a bend is visible. The probe shall be rotated to detect bends. The inspection results shall be documented in the field test report. If a bend in the probe is visible, the horizontal straightness check shall be performed before the probe is used.

8.3 Rotational Position Check. Before each field test, and each time an extension is added to the probe during a field test, a rotational position check shall be performed on all manually operated probes (except as noted in section 8.3.5 below) to ensure that, throughout testing, the angle-measuring device is either: aligned to within ±1° of the rotational position of the reference scribe line; or is affixed to the probe such that the rotational offset of the device from the reference scribe line is known to within ±1°. This check shall consist of direct measurements of the rotational positions of the reference scribe line and angle-measuring device sufficient to verify that these specifications are met. Annex A in section 18 of this method gives recommended procedures for performing the rotational position check, and Table 2G–2 gives an example data form. Procedures other than those recommended in Annex A in section 18 may be used, provided they demonstrate whether the alignment specification is met and are explained in detail in the field test report.

8.3.1 Angle-measuring device rotational offset. The tester shall maintain a record of the angle-measuring device rotational offset, R_{ADO}, as defined in section 3.1. Note that R_{ADO} is assigned a value of 0° when the angle-measuring device is aligned to within ±1° of the rotational position of the reference scribe line. The R_{ADO} shall be used to determine the yaw angle of flow in accordance with section 8.9.4.

8.3.2 Sign of angle-measuring device rotational offset. The sign of R_{ADO} is positive when the angle-measuring device (as viewed from the "tail" end of the probe) is positioned in a clockwise direction from the reference scribe line and negative when the device is positioned in a counterclockwise direction from the reference scribe line.

8.3.3 Angle-measuring devices that can be independently adjusted (e.g., by means of a set screw), after being locked into position on the probe sheath, may be used. However, the R_{ADO} must also take into account this adjustment.

8.3.4 Post-test check. If probe extensions remain attached to the main probe throughout the field test, the rotational position check shall be repeated, at a minimum, at the completion of the field test to ensure that the angle-measuring device has remained within ±2° of its rotational position established prior to testing. At the discretion of the tester, additional checks may be conducted after completion of testing at any sample port or after any test run. If the ±2° specification is not met, all measurements made since the last successful rotational position check must be repeated. Section 18.1.1.3 of Annex A provides an example procedure for performing the post-test check.

8.3.5 Exceptions.

8.3.5.1 A rotational position check need not be performed if, for measurements taken at all velocity traverse points, the yaw angle-measuring device is mounted and aligned directly on the reference scribe line specified in sections 6.1.5.1 and 6.1.5.3 and no independent adjustments, as described in section 8.3.3, are made to device's rotational position.

8.3.5.2 If extensions are detached and re-attached to the probe during a field test, a rotational position check need only be performed the first time an extension is added to the probe, rather than each time the extension is re-attached, if the probe extension is designed to be locked into a mechanically fixed rotational position (e.g., through the use of interlocking grooves), that can re-establish the initial rotational position to within ±1°.

8.4 Leak Checks. A pre-test leak check shall be conducted before each field test. A post-test check shall be performed at the end of the field test, but additional leak checks may be conducted after any test run or group of test runs. The post-test check may also serve as the pre-test check for the next group of test runs. If any leak check is failed, all runs since the last passed leak check are invalid. While performing the leak check procedures, also check each pressure device's responsiveness to changes in pressure.

8.4.1 To perform the leak check on a Type S pitot tube, pressurize the pitot impact opening until at least 7.6 cm H_2O (3 in. H_2O) velocity pressure, or a pressure corresponding to approximately 75 percent of the pressure device's measurement scale, whichever is less, registers on the pressure device; then, close off the impact opening. The pressure shall remain stable (±2.5 mm H_2O, ±0.10 in. H_2O) for at least 15 seconds. Repeat this procedure for the static pressure side, except use suction to obtain the required pressure. Other leak-check procedures may be used, if approved by the Administrator.

8.4.2 To perform the leak check on a 3–D probe, pressurize the probe's impact (P_1) opening until at least 7.6 cm H_2O (3 in. H_2O) velocity pressure, or a pressure corresponding to approximately 75 percent of the pressure device's measurement scale, whichever is less, registers on the pressure device; then, close off the impact opening. The pressure shall remain stable (±2.5 mm

H_2O, ±0.10 in. H_2O) for at least 15 seconds. Check the P_2 and P_3 pressure ports in the same fashion. Other leak-check procedures may be used, if approved by the Administrator.

8.5 Zeroing the Differential Pressure-measuring Device. Zero each differential pressure-measuring device, including the device used for yaw nulling, before each field test. At a minimum, check the zero after each field test. A zero check may also be performed after any test run or group of test runs. For fluid manometers and mechanical pressure gauges (e.g., Magnehelic® gauges), the zero reading shall not deviate from zero by more than ±0.8 mm H_2O (±0.03 in. H_2O) or one minor scale division, whichever is greater, between checks. For electronic manometers, the zero reading shall not deviate from zero between checks by more than: ±0.3 mm H_2O (±0.01 in. H_2O), for full scales less than or equal to 5.1 cm H_2O (2.0 in. H_2O); or ±0.8 mm H_2O (±0.03 in. H_2O), for full scales greater than 5.1 cm H_2O (2.0 in. H_2O). (**Note:** If negative zero drift is not directly readable, estimate the reading based on the position of the gauge oil in the manometer or of the needle on the pressure gauge.) In addition, for all pressure-measuring devices except those used exclusively for yaw nulling, the zero reading shall not deviate from zero by more than 5 percent of the average measured differential pressure at any distinct process condition or load level. If any zero check is failed at a specific process condition or load level, all runs conducted at that process condition or load level since the last passed zero check are invalid.

8.6 Traverse Point Verification. The number and location of the traverse points shall be selected based on Method 1 guidelines. The stack or duct diameter and port nipple lengths, including any extension of the port nipples into the stack or duct, shall be verified the first time the test is performed; retain and use this information for subsequent field tests, updating it as required. Physically measure the stack or duct dimensions or use a calibrated laser device; do not use engineering drawings of the stack or duct. The probe length necessary to reach each traverse point shall be recorded to within ±6.4 mm (±¼ in.) and, for manual probes, marked on the probe sheath. In determining these lengths, the tester shall take into account both the distance that the port flange projects outside of the stack and the depth that any port nipple extends into the gas stream. The resulting point positions shall reflect the true distances from the inside wall of the stack or duct, so that when the tester aligns any of the markings with the outside face of the stack port, the probe's impact port shall be located at the appropriate distance from the inside wall for the respective Method 1 traverse point. Before beginning testing at a particular location, an out-of-stack or duct verification shall be performed on each probe that will be used to ensure that these position markings are correct. The distances measured during the verification must agree with the previously calculated distances to within ±¼ in. For manual probes, the traverse point positions shall be verified by measuring the distance of each mark from the probe's impact pressure port (the P_1 port for a 3-D probe). A comparable out-of-stack test shall be performed on automated probe systems. The probe shall be extended to each of the prescribed traverse point positions. Then, the accuracy of the positioning for each traverse point shall be verified by measuring the distance between the port flange and the probe's impact pressure port.

8.7 Probe Installation. Insert the probe into the test port. A solid material shall be used to seal the port.

8.8 System Response Time. Determine the response time of the probe measurement system. Insert and position the "cold" probe (at ambient temperature and pressure) at any Method 1 traverse point. Read and record the probe differential pressure, temperature, and elapsed time at 15-second intervals until stable readings for both pressure and temperature are achieved. The response time is the longer of these two elapsed times. Record the response time.

8.9 Sampling.

8.9.1 Yaw angle measurement protocol. With manual probes, yaw angle measurements may be obtained in two alternative ways during the field test, either by using a yaw angle-measuring device (e.g., digital inclinometer) affixed to the probe, or using a protractor wheel and pointer assembly. For horizontal traversing, either approach may be used. For vertical traversing, i.e., when measuring from on top or into the bottom of a horizontal duct, only the protractor wheel and pointer assembly may be used. With automated probes, curve-fitting protocols may be used to obtain yaw-angle measurements.

8.9.1.1 If a yaw angle-measuring device affixed to the probe is to be used, lock the device on the probe sheath, aligning it either on the reference scribe line or in the rotational offset position established under section 8.3.1.

8.9.1.2 If a protractor wheel and pointer assembly is to be used, follow the procedures in Annex B of this method.

8.9.1.3 Curve-fitting procedures. Curve-fitting routines sweep through a range of yaw angles to create curves correlating pressure to yaw position. To find the zero yaw position and the yaw angle of flow, the curve found in the stack is computationally compared to a similar curve that was previously generated under controlled conditions in a wind tunnel. A probe system that uses a curve-fitting routine for determining the yaw-null position of the probe head may be used, provided that it is verified in a wind tunnel to be able to determine the yaw angle of flow to within ±1°.

8.9.1.4 Other yaw angle determination procedures. If approved by the Administrator, other procedures for determining yaw angle may be used, provided that they are verified in a wind tunnel to be able to perform the yaw angle calibration procedure as described in section 10.5.

8.9.2 Sampling strategy. At each traverse point, first yaw-null the probe, as described in section 8.9.3, below. Then, with the probe oriented into the direction of flow, measure and record the yaw angle, the differential pressure and the temperature at the traverse point, after stable readings are achieved, in accordance with sections 8.9.4 and 8.9.5. At the start of testing in each port (i.e., after a probe has been inserted into the flue gas stream), allow at least the response time to elapse before beginning to take measurements at the first traverse point accessed from that port. Provided that the probe is not removed from the flue gas stream, measurements may be taken at subsequent traverse points accessed from the same test port without waiting again for the response time to elapse.

8.9.3 Yaw-nulling procedure. In preparation for yaw angle determination, the probe must first be yaw nulled. After positioning the probe at the appropriate traverse point, perform the following procedures.

8.9.3.1 For Type S probes, rotate the probe until a null differential pressure reading is obtained. The direction of the probe rotation shall be such that the thermocouple is located downstream of the probe pressure ports at the yaw-null position. Rotate the probe 90° back from the yaw-null position to orient the impact pressure port into the direction of flow. Read and record the angle displayed by the angle-measuring device.

8.9.3.2 For 3-D probes, rotate the probe until a null differential pressure reading (the difference in pressures across the P_2 and P_3 pressure ports is zero, i.e., $P_2 = P_3$) is indicated by the yaw angle pressure gauge. Read and record the angle displayed by the angle-measuring device.

8.9.3.3 Sign of the measured angle. The angle displayed on the angle-measuring device is considered positive when the probe's impact pressure port (as viewed from the "tail" end of the probe) is oriented in a clockwise rotational position relative to the stack or duct axis and is considered negative when the probe's impact pressure port is oriented in a counterclockwise rotational position (see Figure 2G-7).

8.9.4 Yaw angle determination. After performing the applicable yaw-nulling procedure in section 8.9.3, determine the yaw angle of flow according to one of the following procedures. Special care must be observed to take into account the signs of the recorded angle reading and all offsets.

8.9.4.1 Direct-reading. If all rotational offsets are zero or if the angle-measuring device rotational offset (R_{ADO}) determined in section 8.3 exactly compensates for the scribe line rotational offset (R_{SLO}) determined in section 10.5, then the magnitude of the yaw angle is equal to the displayed angle-measuring device reading from section 8.9.3.1 or 8.9.3.2. The algebraic sign of the yaw angle is determined in accordance with section 8.9.3.3. [**Note:** Under certain circumstances (e.g., testing of horizontal ducts) a 90° adjustment to the angle-measuring device readings may be necessary to obtain the correct yaw angles.]

8.9.4.2 Compensation for rotational offsets during data reduction. When the angle-measuring device rotational offset does not compensate for reference scribe line rotational offset, the following procedure shall be used to determine the yaw angle:

(a) Enter the reading indicated by the angle-measuring device from section 8.9.3.1 or 8.9.3.2.

(b) Associate the proper algebraic sign from section 8.9.3.3 with the reading in step (a).

(c) Subtract the reference scribe line rotational offset, R_{SLO}, from the reading in step (b).

(d) Subtract the angle-measuring device rotational offset, R_{ADO}, if any, from the result obtained in step (c).

(e) The final result obtained in step (d) is the yaw angle of flow.

[Note: It may be necessary to first apply a 90° adjustment to the reading in step (a), in order to obtain the correct yaw angle.]

8.9.4.3 Record the yaw angle measurements on a form similar to Table 2G–3.

8.9.5 Impact velocity determination. Maintain the probe rotational position established during the yaw angle determination. Then, begin recording the pressure-measuring device readings. These pressure measurements shall be taken over a sampling period of sufficiently long duration to ensure representative readings at each traverse point. If the pressure measurements are determined from visual readings of the pressure device or display, allow sufficient time to observe the pulsation in the readings to obtain a sight-weighted average, which is then recorded manually. If an automated data acquisition system (e.g., data logger, computer-based data recorder, strip chart recorder) is used to record the pressure measurements, obtain an integrated average of all pressure readings at the traverse point. Stack or duct gas temperature measurements shall be recorded, at a minimum, once at each traverse point. Record all necessary data as shown in the example field data form (Table 2G–3).

8.9.6 Alignment check. For manually operated probes, after the required yaw angle and differential pressure and temperature measurements have been made at each traverse point, verify (e.g., by visual inspection) that the yaw angle-measuring device has remained in proper alignment with the reference scribe line or with the rotational offset position established in section 8.3. If, for a particular traverse point, the angle-measuring device is found to be in proper alignment, proceed to the next traverse point; otherwise, re-align the device and repeat the angle and differential pressure measurements at the traverse point. In the course of a traverse, if a mark used to properly align the angle-measuring device (e.g., as described in section 18.1.1.1) cannot be located, re-establish the alignment mark before proceeding with the traverse.

8.10 Probe Plugging. Periodically check for plugging of the pressure ports by observing the responses on the pressure differential readouts. Plugging causes erratic results or sluggish responses. Rotate the probe to determine whether the readouts respond in the expected direction. If plugging is detected, correct the problem and repeat the affected measurements.

8.11 Static Pressure. Measure the static pressure in the stack or duct using the equipment described in section 6.7.

8.11.1 If a Type S probe is used for this measurement, position the probe at or between any traverse point(s) and rotate the probe until a null differential pressure reading is obtained. Disconnect the tubing from one of the pressure ports; read and record the Δ P. For pressure devices with one-directional scales, if a deflection in the positive direction is noted with the negative side disconnected, then the static pressure is positive. Likewise, if a deflection in the positive direction is noted with the positive side disconnected, then the static pressure is negative.

8.11.2 If a 3–D probe is used for this measurement, position the probe at or between any traverse point(s) and rotate the probe until a null differential pressure reading is obtained at P_2–P_3. Rotate the probe 90°. Disconnect the P_2 pressure side of the probe and read the pressure P_1–P_{bar} and record as the static pressure. (Note: The spherical probe, specified in section 6.1.2 of Method 2F, is unable to provide this measurement and shall not be used to take static pressure measurements.)

8.12 Atmospheric Pressure. Determine the atmospheric pressure at the sampling elevation during each test run following the procedure described in section 2.5 of Method 2.

8.13 Molecular Weight. Determine the stack or duct gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO, and N_2, use Method 3 or 3A. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. Other methods may be used, if approved by the Administrator.

8.14 Moisture. Determine the moisture content of the stack gas using Method 4 or equivalent.

8.15 Data Recording and Calculations. Record all required data on a form similar to Table 2G–3.

8.15.1 2–D probe calibration coefficient. When a Type S pitot tube is used in the field, the appropriate calibration coefficient as determined in section 10.6 shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A-side coefficient shall be used when the A-side of the tube faces the flow, and the B-side coefficient shall be used when the B-side faces the flow.

8.15.2 3–D calibration coefficient. When a 3–D probe is used to collect data with this method, follow the provisions for the calibration of 3–D probes in section 10.6 of Method 2F to obtain the appropriate velocity calibration coefficient (F_2 as derived using Equation 2F–2 in Method 2F) corresponding to a pitch angle position of 0°.

8.15.3 Calculations. Calculate the yaw-adjusted velocity at each traverse point using the equations presented in section 12.2. Calculate the test run average stack gas velocity by finding the arithmetic average of the point velocity results in accordance with sections 12.3 and 12.4, and calculate the stack gas volumetric flow rate in accordance with section 12.5 or 12.6, as applicable.

9.0 Quality Control

9.1 Quality Control Activities. In conjunction with the yaw angle determination and the pressure and temperature measurements specified in section 8.9, the following quality control checks should be performed.

9.1.1 Range of the differential pressure gauge. In accordance with the specifications in section 6.4, ensure that the proper differential pressure gauge is being used for the range of Δ P values encountered. If it is necessary to change to a more sensitive gauge, replace the gauge with a gauge calibrated according to section 10.3.3, perform the leak check described in section 8.4 and the zero check described in section 8.5, and repeat the differential pressure and temperature readings at each traverse point.

9.1.2 Horizontal stability check. For horizontal traverses of a stack or duct, visually check that the probe shaft is maintained in a horizontal position prior to taking a pressure reading. Periodically, during a test run, the probe's horizontal stability should be verified by placing a carpenter's level, a digital inclinometer, or other angle-measuring device on the portion of the probe sheath that extends outside of the test port. A comparable check should be performed by automated systems.

10.0 Calibration

10.1 Wind Tunnel Qualification Checks. To qualify for use in calibrating probes, a wind tunnel shall have the design features specified in section 6.11 and satisfy the following qualification criteria. The velocity pressure cross-check in section 10.1.1 and axial flow verification in section 10.1.2 shall be performed before the initial use of the wind tunnel and repeated immediately after any alteration occurs in the wind tunnel's configuration, fans, interior surfaces, straightening vanes, controls, or other properties that could reasonably be expected to alter the flow pattern or velocity stability in the tunnel. The owner or operator of a wind tunnel used to calibrate probes according to this method shall maintain records documenting that the wind tunnel meets the requirements of sections 10.1.1 and 10.1.2 and shall provide these records to the Administrator upon request.

10.1.1 Velocity pressure cross-check. To verify that the wind tunnel produces the same velocity at the tested probe head as at the calibration pitot tube impact port, perform the following cross-check. Take three differential pressure measurements at the fixed calibration pitot tube location, using the calibration pitot tube specified in section 6.10, and take three measurements with the calibration pitot tube at the wind tunnel calibration location, as defined in section 3.21. Alternate the measurements between the two positions. Perform this procedure at the lowest and highest velocity settings at which the probes will be calibrated. Record the values on a form similar to Table 2G–4. At each velocity setting, the average velocity pressure obtained at the wind tunnel calibration location shall be within ±2 percent or 2.5 mm H_2O (0.01 in. H_2O), whichever is less restrictive, of the average velocity pressure obtained at the fixed calibration pitot tube location. This comparative check shall be performed at 2.5-cm (1-in.), or smaller, intervals across the full length, width, and depth (if applicable) of the wind tunnel calibration location. If the criteria are not met at every tested point, the wind tunnel calibration location must be redefined, so that acceptable results are obtained at every point. Include the results of the velocity pressure cross-check in the calibration data section of the field test report. (See section 16.1.4.)

10.1.2 Axial flow verification. The following procedures shall be performed to demonstrate that there is fully developed axial flow within the wind tunnel calibration location and at the calibration pitot tube location. Two options are available to conduct this check.

10.1.2.1 Using a calibrated 3-D probe. A probe that has been previously calibrated in a wind tunnel with documented axial flow (as defined in section 3.22) may be used to conduct this check. Insert the calibrated 3-D probe into the wind tunnel test section using the tested probe port. Following the procedures in sections 8.9 and 12.2 of Method 2F, determine the yaw and pitch angles at all the point(s) in the test section where the velocity pressure cross-check, as specified in section 10.1.1, is performed. This includes all the points in the calibration location and the point where the calibration pitot tube will be located. Determine the yaw and pitch angles at each point. Repeat these measurements at the highest and lowest velocities at which the probes will be calibrated. Record the values on a form similar to Table 2G–5. Each measured yaw and pitch angle shall be within ±3@ of 0@. Exceeding the limits indicates unacceptable flow in the test section. Until the problem is corrected and acceptable flow is verified by repetition of this procedure, the wind tunnel shall not be used for calibration of probes. Include the results of the axial flow verification in the calibration data section of the field test report. (See section 16.1.4.)

10.1.2.2 Using alternative probes. Axial flow verification may be performed using an uncalibrated prism-shaped 3-D probe (e.g., DA or DAT probe) or an uncalibrated wedge probe. (Figure 2G–8 illustrates a typical wedge probe.) This approach requires use of two ports: the tested probe port and a second port located 90° from the tested probe port. Each port shall provide access to all the points within the wind tunnel test section where the velocity pressure cross-check, as specified in section 10.1.1, is conducted. The probe setup shall include establishing a reference yaw-null position on the probe sheath to serve as the location for installing the angle-measuring device. Physical design features of the DA, DAT, and wedge probes are relied on to determine the reference position. For the DA or DAT probe, this reference position can be determined by setting a digital inclinometer on the flat facet where the P_1 pressure port is located and then identifying the rotational position on the probe sheath where a second angle-measuring device would give the same angle reading. The reference position on a wedge probe shaft can be determined either geometrically or by placing a digital inclinometer on each side of the wedge and rotating the probe until equivalent readings are obtained. With the latter approach, the reference position is the rotational position on the probe sheath where an angle-measuring device would give a reading of 0°. After installation of the angle-measuring device in the reference yaw-null position on the probe sheath, determine the yaw angle from the tested port. Repeat this measurement using the 90° offset port, which provides the pitch angle of flow. Determine the yaw and pitch angles at all the point(s) in the test section where the velocity pressure cross-check, as specified in section 10.1.1, is performed. This includes all the points in the wind tunnel calibration location and the point where the calibration pitot tube will be located. Perform this check at the highest and lowest velocities at which the probes will be calibrated. Record the values on a form similar to Table 2G–5. Each measured yaw and pitch angle shall be within ±3° of 0°. Exceeding the limits indicates unacceptable flow in the test section. Until the problem is corrected and acceptable flow is verified by repetition of this procedure, the wind tunnel shall not be used for calibration of probes. Include the results in the probe calibration report.

10.1.3 Wind tunnel audits.

10.1.3.1 Procedure. Upon the request of the Administrator, the owner or operator of a wind tunnel shall calibrate a 2-D audit probe in accordance with the procedures described in sections 10.3 through 10.6. The calibration shall be performed at two velocities that encompass the velocities typically used for this method at the facility. The resulting calibration data shall be submitted to the Agency in an audit test report. These results shall be compared by the Agency to reference calibrations of the audit probe at the same velocity settings obtained at two different wind tunnels.

10 1.3.2 Acceptance criterion. The audited tunnel's calibration coefficient is acceptable if it is within 3 percent of the reference calibrations obtained at each velocity setting by one (or both) of the wind tunnels. If the acceptance criterion is not met at each calibration velocity setting, the audited wind tunnel shall not be used to calibrate probes for use under this method until the problems are resolved and acceptable results are obtained upon completion of a subsequent audit.

10.2 Probe Inspection.

10.2.1 Type S probe. Before each calibration of a Type S probe, verify that one leg of the tube is permanently marked A, and the other, B. Carefully examine the pitot tube from the top, side, and ends. Measure the angles (α_1, α_2, β_1, and β_2) and the dimensions (w and z) illustrated in Figures 2–2 and 2–3 in Method 2. Also measure the dimension A, as shown in the diagram in Table 2G–1, and the external tubing diameter (dimension D_t, Figure 2–2b in Method 2). For the purposes of this method, D_t shall be no less than 9.5 mm (3/8 in.). The base-to-opening plane distances P_A and P_B in Figure 2–3 of Method 2 shall be equal, and the dimension A in Table 2G–1 should be between $2.10D_t$ and $3.00D_t$. Record the inspection findings and probe measurements on a form similar to Table CD2–1 of the "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III, Stationary Source-Specific Methods" (EPA/600/R–94/038c, September 1994). For reference, this form is reproduced herein as Table 2G–1. The pitot tube shall not be used under this method if it fails to meet the specifications in this section and the alignment specifications in section 6.1.1. All Type S probes used to collect data with this method shall be calibrated according to the procedures outlined in sections 10.3 through 10.6 below. During calibration, each Type S pitot tube shall be configured in the same manner as used, or planned to be used, during the field test, including all components in the probe assembly (e.g., thermocouple, probe sheath, sampling nozzle). Probe shaft extensions that do not affect flow around the probe head need not be attached during calibration.

10.2.2 3-D probe. If a 3-D probe is used to collect data with this method, perform the pre-calibration inspection according to procedures in Method 2F, section 10.2.

10.3 Pre-Calibration Procedures. Prior to calibration, a scribe line shall have been placed on the probe in accordance with section 10.4. The yaw angle and velocity calibration procedures shall not begin until the pre-test requirements in sections 10.3.1 through 10.3.4 have been met.

10.3.1 Perform the horizontal straightness check described in section 8.2 on the probe assembly that will be calibrated in the wind tunnel.

10.3.2 Perform a leak check in accordance with section 8.4.

10.3.3 Except as noted in section 10.3.3.3, calibrate all differential pressure-measuring devices to be used in the probe calibrations, using the following procedures. At a minimum, calibrate these devices on each day that probe calibrations are performed.

10.3.3.1 Procedure. Before each wind tunnel use, all differential pressure-measuring devices shall be calibrated against the reference device specified in section 6.4.3 using a common pressure source. Perform the calibration at three reference pressures representing 30, 60, and 90 percent of the full-scale range of the pressure-measuring device being calibrated. For an inclined-vertical manometer, perform separate calibrations on the inclined and vertical portions of the measurement scale, considering each portion of the scale to be a separate full-scale range. [For example, for a manometer with a 0-to 2.5-cm H_2O (0-to 1-in. H_2O) inclined scale and a 2.5-to 12.7-cm H_2O (1-to 5-in. H_2O) vertical scale, calibrate the inclined portion at 7.6, 15.2, and 22.9 mm H_2O (0.3, 0.6, and 0.9 in. H_2O), and calibrate the vertical portion at 3.8, 7.6, and 11.4 cm H_2O (1.5, 3.0, and 4.5 in. H_2O).] Alternatively, for the vertical portion of the scale, use three evenly spaced reference pressures, one of which is equal to or higher than the highest differential pressure expected in field applications.

10.3.3.2 Acceptance criteria. At each pressure setting, the two pressure readings made using the reference device and the pressure-measuring device being calibrated shall agree to within #2 percent of full scale of the device being calibrated or 0.5 mm H_2O (0.02 in. H_2O), whichever is less restrictive. For an inclined-vertical manometer, these requirements shall be met separately using the respective full-scale upper limits of the inclined and vertical portions of the scale. Differential pressure-measuring devices not meeting the #2 percent of full scale or 0.5 mm H_2O (0.02 in. H_2O) calibration requirement shall not be used.

10.3.3.3 Exceptions. Any precision manometer that meets the specifications for a reference device in section 6.4.3 and that is not used for field testing does not require calibration, but must be leveled and zeroed before each wind tunnel use. Any pressure device used exclusively for yaw nulling does not require calibration, but shall be checked for responsiveness to rotation of the probe prior to each wind tunnel use.

10.3.4 Calibrate digital inclinometers on each day of wind tunnel or field testing (prior to beginning testing) using the following procedures. Calibrate the inclinometer according to the manufacturer's calibration procedures. In addition, use a triangular block (illustrated in Figure 2G–9) with a known angle, ", independently determined using a protractor or equivalent device, between two adjacent sides to verify the inclinometer readings. (**Note:** If other angle-measuring devices meeting the provisions of section 6.2.3 are used in place of a digital inclinometer, comparable calibration procedures shall be performed on such devices.) Secure the triangular block in a fixed position. Place the inclinometer on one side of the block (side A) to measure the angle of inclination (R_1). Repeat this measurement on the adjacent side of the block (side B) using the inclinometer to obtain a second angle reading (R_2). The difference of the sum of the two readings from 180° (i.e., $180R_1R_2$) shall be within #2 of the known angle, ".

10.4 Placement of Reference Scribe Line. Prior to the first calibration of a probe, a line shall be permanently inscribed on the main probe sheath to serve as a reference mark for determining yaw angles. Annex C in section 18 of this method gives a guideline for placement of the reference scribe line.

10.4.1 This reference scribe line shall meet the specifications in sections 6.1.5.1 and 6.1.5.3 of this method. To verify that the alignment specification in section 6.1.5.3 is met, secure the probe in a horizontal position and measure the rotational angle of each scribe line and scribe line segment using an angle-measuring device that meets the specifications in section 6.2.1 or 6.2.3. For any scribe line that is longer than 30.5 cm (12 in.), check the line's rotational position at 30.5-cm (12-in.) intervals. For each line segment that is 12 in. or less in length, check the rotational position at the two endpoints of the segment. To meet the alignment specification in section 6.1.5.3, the minimum and maximum of all of the rotational angles that are measured along the full length of main probe must not differ by more than 2°. (Note: A short reference scribe line segment [e.g., 15.2 cm (6 in.) or less in length] meeting the alignment specifications in section 6.1.5.3 is fully acceptable under this method. See section 18.1.1.1 of Annex A for an example of a probe marking procedure, suitable for use with a short reference scribe line.)

10.4.2 The scribe line should be placed on the probe first and then its offset from the yaw-null position established (as specified in section 10.5). The rotational position of the reference scribe line relative to the yaw-null position of the probe, as determined by the yaw angle calibration procedure in section 10.5, is the reference scribe line rotational offset, R_{SLO}. The reference scribe line rotational offset shall be recorded and retained as part of the probe's calibration record.

10.4.3 Scribe line for automated probes. A scribe line may not be necessary for an automated probe system if a reference rotational position of the probe is built into the probe system design. For such systems, a "flat" (or comparable, clearly identifiable physical characteristic) should be provided on the probe casing or flange plate to ensure that the reference position of the probe assembly remains in a vertical or horizontal position. The rotational offset of the flat (or comparable, clearly identifiable physical characteristic) needed to orient the reference position of the probe assembly shall be recorded and maintained as part of the automated probe system's specifications.

10.5 Yaw Angle Calibration Procedure. For each probe used to measure yaw angles with this method, a calibration procedure shall be performed in a wind tunnel meeting the specifications in section 10.1 to determine the rotational position of the reference scribe line relative to the probe's yaw-null position. This procedure shall be performed on the main probe with all devices that will be attached to the main probe in the field [such as thermocouples, resistance temperature detectors (RTDs), or sampling nozzles] that may affect the flow around the probe head. Probe shaft extensions that do not affect flow around the probe head need not be attached during calibration. At a minimum, this procedure shall include the following steps.

10.5.1 Align and lock the angle-measuring device on the reference scribe line. If a marking procedure (such as described in section 18.1.1.1) is used, align the angle-measuring device on a mark within ±1° of the rotational position of the reference scribe line. Lock the angle-measuring device onto the probe sheath at this position.

10.5.2 Zero the pressure-measuring device used for yaw nulling.

10.5.3 Insert the probe assembly into the wind tunnel through the entry port, positioning the probe's impact port at the calibration location. Check the responsiveness of the pressure-measurement device to probe rotation, taking corrective action if the response is unacceptable.

10.5.4 Ensure that the probe is in a horizontal position, using a carpenter's level.

10.5.5 Rotate the probe either clockwise or counterclockwise until a yaw null [zero ΔP for a Type S probe or zero (P_2-P_3) for a 3–D probe] is obtained. If using a Type S probe with an attached thermocouple, the direction of the probe rotation shall be such that the thermocouple is located downstream of the probe pressure ports at the yaw-null position.

10.5.6 Use the reading displayed by the angle-measuring device at the yaw-null position to determine the magnitude of the reference scribe line rotational offset, R_{SLO}, as defined in section 3.15. Annex D in section 18 of this method gives a recommended procedure for determining the magnitude of R_{SLO} with a digital inclinometer and a second procedure for determining the magnitude of R_{SLO} with a protractor wheel and pointer device. Table 2G–6 gives an example data form and Table 2G–7 is a look-up table with the recommended procedure. Procedures other than those recommended in Annex D in section 18 may be used, if they can determine R_{SLO} to within 1° and are explained in detail in the field test report. The algebraic sign of R_{SLO} will either be positive if the rotational position of the reference scribe line (as viewed from the "tail" end of the probe) is clockwise, or negative, if counterclockwise with respect to the probe's yaw-null position. (This is illustrated in Figure 2G–10.)

10.5.7 The steps in sections 10.5.3 through 10.5.6 shall be performed twice at each of the velocities at which the probe will be calibrated (in accordance with section 10.6). Record the values of R_{SLO}.

10.5.8 The average of all of the RSLO values shall be documented as the reference scribe line rotational offset for the probe.

10.5.9 Use of reference scribe line offset. The reference scribe line rotational offset shall be used to determine the yaw angle of flow in accordance with section 8.9.4.

10.6 Velocity Calibration Procedure. When a 3–D probe is used under this method, follow the provisions for the calibration of 3–D probes in section 10.6 of Method 2F to obtain the necessary velocity calibration coefficients (F_2 as derived using Equation 2F–2 in Method 2F) corresponding to a pitch angle position of 0°. The following procedure applies to Type S probes. This procedure shall be performed on the main probe and all devices that will be attached to the main probe in the field (e.g., thermocouples, RTDs, sampling nozzles) that may affect the flow around the probe head. Probe shaft extensions that do not affect flow around the probe head need not be attached during calibration. (Note: If a sampling nozzle is part of the assembly, two additional requirements must be satisfied before proceeding. The distance between the nozzle and the pitot tube shall meet the minimum spacing requirement prescribed in Method 2, and a wind tunnel demonstration shall be performed that shows the probe's ability to yaw null is not impaired when the nozzle is drawing sample.) To obtain velocity calibration coefficient(s) for the tested probe, proceed as follows.

10.6.1 Calibration velocities. The tester may calibrate the probe at two nominal wind tunnel velocity settings of 18.3 m/sec and 27.4 m/sec (60 ft/sec and 90 ft/sec) and average the results of these calibrations, as described in sections 10.6.12 through 10.6.14, in order to generate the calibration coefficient, C_p. If this option is selected, this calibration coefficient may be used for all field applications where the velocities are 9.1 m/sec (30 ft/sec) or greater. Alternatively, the tester may customize the probe calibration for a particular field test application (or for a series of applications), based on the expected average velocity(ies) at the test site(s). If this option is selected, generate the calibration coefficients by calibrating the probe at two nominal wind tunnel velocity settings, one of which is less than or equal to and the other greater than or equal to the expected average velocity(ies) for the field application(s), and average the results as described in sections 10.6.12 through 10.6.14. Whichever calibration option is selected, the probe calibration coefficient(s) obtained at the two nominal calibration velocities shall meet the conditions specified in sections 10.6.12 through 10.6.14.

10.6.2 Connect the tested probe and calibration pitot tube to their respective pressure-measuring devices. Zero the pressure-measuring devices. Inspect and leak-check all pitot lines; repair or replace them, if necessary. Turn on the fan, and allow the wind tunnel air flow to stabilize at the first of the selected nominal velocity settings.

10.6.3 Position the calibration pitot tube at its measurement location (determined as outlined in section 6.11.4.3), and align the tube so that its tip is pointed directly into the flow. Ensure that the entry port surrounding the tube is properly sealed. The calibration pitot tube may either remain in the wind tunnel throughout the calibration, or be removed from the wind tunnel while measurements are taken with the probe being calibrated.

10.6.4 Check the zero setting of each pressure-measuring device.

10.6.5 Insert the tested probe into the wind tunnel and align it so that the designated pressure port (e.g., either the A-side or B-side of a Type S probe) is pointed directly into the flow and is positioned within the wind tunnel calibration location (as defined in section 3.21). Secure the probe at the 0° pitch angle position. Ensure that the entry port surrounding the probe is properly sealed.

10.6.6 Read the differential pressure from the calibration pitot tube (ΔPstd), and record its value. Read the barometric pressure to within ±2.5 mm Hg (±0.1 in. Hg) and the temperature in the wind tunnel to within 0.6°C (1°F). Record these values on a data form similar to Table 2G–8.

10.6.7 After the tested probe's differential pressure gauges have had sufficient time to stabilize, yaw null the probe (and then rotate it back 90° for Type S probes), then obtain the differential pressure reading (ΔP). Record the yaw angle and differential pressure readings.

10.6.8 Take paired differential pressure measurements with the calibration pitot tube and tested probe (according to sections 10.6.6 and 10.6.7). The paired measurements in each replicate can be made either simultaneously (i.e., with both probes in the wind tunnel) or by alternating the measurements of the two probes (i.e., with only one probe at a time in the wind tunnel).

10.6.9 Repeat the steps in sections 10.6.6 through 10.6.8 at the same nominal velocity setting until three pairs of ΔP readings have been obtained from the calibration pitot tube and the tested probe.

10.6.10 Repeat the steps in sections 10.6.6 through 10.6.9 above for the A-side and B-side of the Type S pitot tube. For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side that will face the flow). However, the pitot tube must still meet the alignment and dimension specifications in section 6.1.1 and must have an average deviation (σ) value of 0.01 or less as provided in section 10.6.12.4.

10.6.11 Repeat the calibration procedures in sections 10.6.6 through 10.6.10 at the second selected nominal wind tunnel velocity setting.

10.6.12 Perform the following calculations separately on the A-side and B-side values.

10.6.12.1 Calculate a C_p value for each of the three replicates performed at the lower velocity setting where the calibrations were performed using Equation 2–2 in section 4.1.4 of Method 2.

10.6.12.2 Calculate the arithmetic average, $C_{p(avg-low)}$, of the three C_p values.

10.6.12.3 Calculate the deviation of each of the three individual values of C_p from the A-side average $C_{p(avg-low)}$ value using Equation 2–3 in Method 2.

10.6.12.4 Calculate the average deviation (σ) of the three individual C_p values from $C_{p(avg-low)}$ using Equation 2–4 in Method 2. Use the Type S pitot tube only if the values of σ (side A) and σ (side B) are less than or equal to 0.01. If both A-side and B-side calibration coefficients are calculated, the absolute value of the difference between $C_{p(avg-low)}$ (side A) and $C_{p(avg-low)}$ (side B) must not exceed 0.01.

10.6.13 Repeat the calculations in section 10.6.12 using the data obtained at the higher velocity setting to derive the arithmetic C_p values at the higher velocity setting, $C_{p(avg-high)}$, and to determine whether the conditions in 10.6.12.4 are met by both the A-side and B-side calibrations at this velocity setting.

10.6.14 Use equation 2G–1 to calculate the percent difference of the averaged C_p values at the two calibration velocities.

$$\%\text{Difference} = \frac{C_{P(avg\text{-}low)} - C_{P(avg\text{-}high)}}{C_{P(avg\text{-}low)}} \times 100\% \qquad \text{Eq. 2G-1}$$

The percent difference between the averaged C_p values shall not exceed ±3 percent. If the specification is met, average the A-side values of $C_{p(avg-low)}$ and $C_{p(avg-high)}$ to produce a single A-side calibration coefficient, C_p. Repeat for the B-side values if calibrations were performed on that side of the pitot. If the specification is not met, make necessary adjustments in the selected velocity settings and repeat the calibration procedure until acceptable results are obtained.

10.6.15 If the two nominal velocities used in the calibration were 18.3 and 27.4 m/sec (60 and 90 ft/sec), the average C_p from section 10.6.14 is applicable to all velocities 9.1 m/sec (30 ft/sec) or greater. If two other nominal velocities were used in the calibration, the resulting average C_p value shall be applicable only in situations where the velocity calculated using the calibration coefficient is neither less than the lower nominal velocity nor greater than the higher nominal velocity.

10.7 Recalibration. Recalibrate the probe using the procedures in section 10 either within 12 months of its first field use after its most recent calibration or after 10 field tests (as defined in section 3.3), whichever occurs later. In addition, whenever there is visible damage to the probe head, the probe shall be recalibrated before it is used again.

10.8 Calibration of pressure-measuring devices used in the field. Before its initial use in a field test, calibrate each pressure-measuring device (except those used exclusively for yaw nulling) using the three-point calibration procedure described in section 10.3.3. The device shall be recalibrated according to the procedure in section 10.3.3 no later than 90 days after its first field use following its most recent calibration. At the discretion of the tester, more frequent calibrations (e.g., after a field test) may be performed. No adjustments, other than adjustments to the zero setting, shall be made to the device between calibrations.

10.8.1 Post-test calibration check. A single-point calibration check shall be performed on each pressure-measuring device after completion of each field test. At the discretion of the tester, more frequent single-point calibration checks (e.g., after one or more field test runs) may be performed. It is recommended that the post-test check be performed before leaving the field test site. The check shall be performed at a pressure between 50 and 90 percent of full scale by taking a common pressure reading with the tested probe and a reference pressure-measuring device (as described in section 6.4.4) or by challenging the tested device with a reference pressure source (as described in section 6.4.4) or by performing an equivalent check using a reference device approved by the Administrator.

10.8.2 Acceptance criterion. At the selected pressure setting, the pressure readings made using the reference device and the tested device shall agree to within ±3 percent of full scale of the tested device or 0.8 mm H_2O (0.03 in. H_2O), whichever is less restrictive. If this specification is met, the test data collected during the field test are valid. If the specification is not met, all test data collected since the last successful calibration or calibration check are invalid and shall be repeated using a pressure-measuring device with a current, valid calibration. Any device that fails the calibration check shall not be used in a field test until a successful recalibration is performed according to the procedures in section 10.3.3.

10.9 Temperature Gauges. Same as Method 2, section 4.3. The alternative thermocouple calibration procedures outlined in Emission Measurement Center (EMC) Approved Alternative Method (ALT-011) "Alternative Method 2 Thermocouple Calibration Procedure" may be performed. Temperature gauges shall be calibrated no more than 30 days prior to the start of a field test or series of field tests and recalibrated no more than 30 days after completion of a field test or series of field tests.

10.10 Barometer. Same as Method 2, section 4.4. The barometer shall be calibrated no more than 30 days prior to the start of a field test or series of field tests.

11.0 Analytical Procedure

Sample collection and analysis are concurrent for this method (see section 8.0).

12.0 Data Analysis and Calculations

These calculations use the measured yaw angle and the differential pressure and temperature measurements at individual traverse points to derive the near-axial flue gas velocity ($v_{a(i)}$) at each of those points. The near-axial velocity values at all traverse points that comprise a full stack or duct traverse are then averaged to obtain the average near-axial stack or duct gas velocity $v_{a(avg)}$.

12.1 Nomenclature

A = Cross-sectional area of stack or duct at the test port location, m^2 (ft^2).

B_{ws} = Water vapor in the gas stream (from Method 4 or alternative), proportion by volume.

C_p = Pitot tube calibration coefficient, dimensionless.

$F_{2(i)}$ = 3-D probe velocity coefficient at 0 pitch, applicable at traverse point i.

K_p = Pitot tube constant,

$$34.97 \frac{m}{sec}\left[\frac{(g/g\text{-mole})(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$$

for the metric system, and

$$85.49 \frac{ft}{sec}\left[\frac{(lb/lb\text{-mole})(in.\ Hg)}{(°R)(in.\ H_2O)}\right]^{1/2}$$

for the English system.

M_d = Molecular weight of stack or duct gas, dry basis (see section 8.13), g/g-mole (lb/lb-mole).

M_s = Molecular weight of stack or duct gas, wet basis, g/g-mole (lb/lb-mole).

$$M_s = M_d(1-B_{ws}) + 18.0B_{ws} \quad \text{Eq. 2G-2}$$

P_{bar} = Barometric pressure at velocity measurement site, mm Hg (in. Hg).

P_g = Stack or duct static pressure, mm H_2O (in. H_2O).

P_s = Absolute stack or duct pressure, mm Hg (in. Hg),

$$P_s = P_{bar} + \frac{P_g}{13.6} \quad \text{Eq. 2G-3}$$

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

13.6 = Conversion from mm H_2O (in. H_2O) to mm Hg (in. Hg).

Q_{sd} = Average dry-basis volumetric stack or duct gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).

Q_{sw} = Average wet-basis volumetric stack or duct gas flow rate corrected to standard conditions, wscm/hr (wscf/hr).

$t_{s(i)}$ = Stack or duct temperature, °C (°F), at traverse point i.

$T_{s(i)}$ = Absolute stack or duct temperature, °K (°R), at traverse point i.

$$T_{s(i)} = 273 + t_{s(i)} \quad \text{Eq. 2G-4}$$

for the metric system, and

$$T_{s(i)} = 460 + t_{s(i)} \quad \text{Eq. 2G-5}$$

for the English system.

$T_{s(avg)}$=Average absolute stack or duct gas temperature across all traverse points.

T_{std}=Standard absolute temperature, 293°K (528°R).

$v_{a(i)}$=Measured stack or duct gas impact velocity, m/sec (ft/sec), at traverse point i.

$v_{a(avg)}$=Average near-axial stack or duct gas velocity, m/sec (ft/sec) across all traverse points.

ΔP_i=Velocity head (differential pressure) of stack or duct gas, mm H_2O (in. H_2O), applicable at traverse point i.

(P_1-P_2)=Velocity head (differential pressure) of stack or duct gas measured by a 3-D probe, mm H_2O (in. H_2O), applicable at traverse point i.

3,600=Conversion factor, sec/hr.

18.0=Molecular weight of water, g/g-mole (lb/lb-mole).

$\theta_{y(i)}$=Yaw angle of the flow velocity vector, at traverse point i.

n=Number of traverse points.

12.2 Traverse Point Velocity Calculations. Perform the following calculations from the measurements obtained at each traverse point.

12.2.1 Selection of calibration coefficient. Select the calibration coefficient as described in section 10.6.1.

12.2.2 Near-axial traverse point velocity. When using a Type S probe, use the following equation to calculate the traverse point near-axial velocity ($v_{a(i)}$) from the differential pressure (ΔP_i), yaw angle ($\theta_{y(i)}$), absolute stack or duct standard temperature ($T_{s(i)}$) measured at traverse point i, the absolute stack or duct pressure (P_s), and molecular weight (M_s).

$$v_{a(i)} = K_p C_p \sqrt{\frac{(\Delta P)_i T_{s(i)}}{P_s M_s}}\left(\cos\theta_{y(i)}\right) \quad \text{Eq. 2G-6}$$

Use the following equation when using a 3-D probe.

$$v_{a(i)} = K_p F_2 \sqrt{\frac{(P_1-P_2)_i T_{s(i)}}{P_s M_s}}\left(\cos\theta_{y(i)}\right) \quad \text{Eq. 2G-7}$$

12.2.3 Handling multiple measurements at a traverse point. For pressure or temperature devices that take multiple measurements at a traverse point, the multiple measurements (or where applicable, their square roots) may first be averaged and the resulting average values used in the equations above. Alternatively, the individual measurements may be used in the equations above and the resulting calculated values may then be averaged to obtain a single traverse point value. With either approach, all of the individual measurements recorded at a traverse point must be used in calculating the applicable traverse point value.

12.3 Average Near-Axial Velocity in Stack or Duct. Use the reported traverse point near-axial velocity in the following equation.

$$v_{a(avg)} = \frac{\sum_{i=1}^{n} v_{a(i)}}{n} \quad \text{Eq. 2G-8}$$

12.4 Acceptability of Results. The acceptability provisions in section 12.4 of Method 2F apply to 3-D probes used under Method 2G. The following provisions apply to Type S probes. For Type S probes, the test results are acceptable and the calculated value of $v_{a(avg)}$ may be reported as the average near-axial velocity for the test run if the conditions in either section 12.4.1 or 12.4.2 are met.

12.4.1 The average calibration coefficient C_p used in Equation 2G-6 was generated at nominal velocities of 18.3 and 27.4 m/sec (60 and 90 ft/sec) and the value of $v_{a(avg)}$ calculated using Equation 2G–8 is greater than or equal to 9.1 m/sec (30 ft/sec).

12.4.2 The average calibration coefficient C_p used in Equation 2G–6 was generated at nominal velocities other than 18.3 or 27.4 m/sec (60 or 90 ft/sec) and the value of $v_{a(avg)}$ calculated using Equation 2G–8 is greater than or equal to the lower nominal velocity and less than or equal to the higher nominal velocity used to derive the average C_p.

12.4.3 If the conditions in neither section 12.4.1 nor section 12.4.2 are met, the test results obtained from Equation 2G–8 are not acceptable, and the steps in sections 12.2 and 12.3 must be repeated using an average calibration coefficient C_p that satisfies the conditions in section 12.4.1 or 12.4.2.

12.5 Average Gas Volumetric Flow Rate in Stack or Duct (Wet Basis). Use the following equation to compute the average volumetric flow rate on a wet basis.

$$Q_{sw} = 3{,}600\left(v_{a(avg)}\right)(A)\left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right) \qquad \text{Eq. 2G-9}$$

12.6 Average Gas Volumetric Flow Rate in Stack or Duct (Dry Basis). Use the following equation to compute the average volumetric flow rate on a dry basis.

$$Q_{sd} = 3{,}600\left(1-B_{ws}\right)\left(v_{a(avg)}\right)(A)\left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right) \qquad \text{Eq. 2G-10}$$

13.0 Method Performance. [Reserved]

14.0 Pollution Prevention. [Reserved]

15.0 Waste Management. [Reserved]

16.0 Reporting.

16.1 Field Test Reports. Field test reports shall be submitted to the Agency according to applicable regulatory requirements. Field test reports should, at a minimum, include the following elements.

16.1.1 Description of the source. This should include the name and location of the test site, descriptions of the process tested, a description of the combustion source, an accurate diagram of stack or duct cross-sectional area at the test site showing the dimensions of the stack or duct, the location of the test ports, and traverse point locations and identification numbers or codes. It should also include a description and diagram of the stack or duct layout, showing the distance of the test location from the nearest upstream and downstream disturbances and all structural elements (including breachings, baffles, fans, straighteners, etc.) affecting the flow pattern. If the source and test location descriptions have been previously submitted to the Agency in a document (e.g., a monitoring plan or test plan), referencing the document in lieu of including this information in the field test report is acceptable.

16.1.2 Field test procedures. These should include a description of test equipment and test procedures. Testing conventions, such as traverse point numbering and measurement sequence (e.g., sampling from center to wall, or wall to center), should be clearly stated. Test port identification and directional reference for each test port should be included on the appropriate field test data sheets.

16.1.3 Field test data.

16.1.3.1 Summary of results. This summary should include the dates and times of testing, and the average near-axial gas velocity and the average flue gas volumetric flow results for each run and tested condition.

16.1.3.2 Test data. The following values for each traverse point should be recorded and reported:

(a) Differential pressure at traverse point i (ΔP_i)
(b) Stack or duct temperature at traverse point i ($t_{s(i)}$)
(c) Absolute stack or duct temperature at traverse point i ($T_{s(i)}$)
(d) Yaw angle at traverse point i ($\theta_{y(i)}$)
(e) Stack gas near-axial velocity at traverse point i ($v_{a(i)}$)

16.1.3.3 The following values should be reported once per run:

(a) Water vapor in the gas stream (from Method 4 or alternative), proportion by volume (B_{ws}), measured at the frequency specified in the applicable regulation
(b) Molecular weight of stack or duct gas, dry basis (M_d)
(c) Molecular weight of stack or duct gas, wet basis (M_s)
(d) Stack or duct static pressure (P_g)
(e) Absolute stack or duct pressure (P_s)
(f) Carbon dioxide concentration in the flue gas, dry basis ($\%_d$ CO_2)
(g) Oxygen concentration in the flue gas, dry basis ($\%_d$ O_2)
(h) Average near-axial stack or duct gas velocity ($v_{a(avg)}$) across all traverse points
(i) Gas volumetric flow rate corrected to standard conditions, dry or wet basis as required by the applicable regulation (Q_{sd} or Q_{sw})

16.1.3.4 The following should be reported once per complete set of test runs:

(a) Cross-sectional area of stack or duct at the test location (A)
(b) Pitot tube calibration coefficient (C_p)
(c) Measurement system response time (sec)
(d) Barometric pressure at measurement site (P_{bar})

16.1.4 Calibration data. The field test report should include calibration data for all probes and test equipment used in the field test. At a minimum, the probe calibration data reported to the Agency should include the following:

(a) Date of calibration
(b) Probe type
(c) Probe identification number(s) or code(s)
(d) Probe inspection sheets
(e) Pressure measurements and calculations used to obtain calibration coefficients in accordance with section 10.6 of this method
(f) Description and diagram of wind tunnel used for the calibration, including dimensions of cross-sectional area and position and size of the test section
(g) Documentation of wind tunnel qualification tests performed in accordance with section 10.1 of this method

16.1.5 Quality assurance. Specific quality assurance and quality control procedures used during the test should be described.

17.0 Bibliography.

(1) 40 CFR Part 60, Appendix A, Method 1—Sample and velocity traverses for stationary sources.
(2) 40 CFR Part 60, Appendix A, Method 2—Determination of stack gas velocity and volumetric flow rate (Type S pitot tube).
(3) 40 CFR Part 60, Appendix A, Method 2F—Determination of stack gas velocity and volumetric flow rate with three-dimensional probes.
(4) 40 CFR Part 60, Appendix A, Method 2H—Determination of stack gas velocity taking into account velocity decay near the stack wall.
(5) 40 CFR Part 60, Appendix A, Method 3—Gas analysis for carbon dioxide, oxygen, excess air, and dry molecular weight.
(6) 40 CFR Part 60, Appendix A, Method 3A—Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources (instrumental analyzer procedure).
(7) 40 CFR Part 60, Appendix A, Method 4—Determination of moisture content in stack gases.
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(17) National Institute of Standards and Technology, 1998, "Report of Special Test of Air Speed Instrumentation, Eight Spherical Probes," Prepared for the U.S. Environmental Protection Agency under IAG #DW13938432-01-0.
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(20) Page, J.J., E.A. Potts, and R.T. Shigehara, "3-D Pitot Tube Calibration Study," EPA Contract No. 68D10009, Work Assignment No. I-121, March 11, 1993.
(21) Shigehara, R.T., W.F. Todd, and W.S. Smith, "Significance of Errors in Stack Sampling Measurements," Presented at the Annual Meeting of the Air Pollution Control Association, St. Louis, Missouri, June 1419, 1970.
(22) The Cadmus Group, Inc., May 1999, "EPA Flow Reference Method Testing and Analysis: Findings Report," EPA/430-R-99-009.
(23) The Cadmus Group, Inc., 1998, "EPA Flow Reference Method Testing and Analysis: Data Report, Texas Utilities, DeCordova Steam Electric Station, Volume I: Test Description and Appendix A (Data Distribution Package)," EPA/430-R-98-015a.
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18.0 Annexes

Annex A, C, and D describe recommended procedures for meeting certain provisions in sections 8.3, 10.4, and 10.5 of this method. Annex B describes procedures to be followed when using the protractor wheel and pointer assembly to measure yaw angles, as provided under section 8.9.1.

18.1 Annex A—Rotational Position Check. The following are recommended procedures that may be used to satisfy the rotational position check requirements of section 8.3 of this method and to determine the angle-measuring device rotational offset (R_{ADO}).

18.1.1 Rotational position check with probe outside stack. Where physical constraints at the sampling location allow full assembly of the probe outside the stack and insertion into the test port, the following procedures should be performed before the start of testing. Two angle-measuring devices that meet the specifications in section 6.2.1 or 6.2.3 are required for the rotational position check. An angle measuring device whose position can be independently adjusted (e.g., by means of a set screw) after being locked into position on the probe sheath shall not be used for this check unless the independent adjustment is set so that the device performs exactly like a device without the capability for independent adjustment. That is, when aligned on the probe such a device must give the same reading as a device that does not have the capability of being independently adjusted. With the fully assembled probe (including probe shaft extensions, if any) secured in a horizontal position, affix one yaw angle-measuring device to the probe sheath and lock it into position on the reference scribe line specified in section 6.1.5.1. Position the second angle-measuring device using the procedure in section 18.1.1.1 or 18.1.1.2.

18.1.1.1 Marking procedure. The procedures in this section should be performed at each location on the fully assembled probe where the yaw angle-measuring device will be mounted during the velocity traverse. Place the second yaw angle-measuring device on the main probe sheath (or extension) at the position where a yaw angle will be measured during the velocity traverse. Adjust the position of the second angle-measuring device until it indicates the same angle (±1°) as the reference device, and affix the second device to the probe sheath (or extension). Record the angles indicated by the two angle-measuring devices on a form similar to table 2G-2. In this position, the second angle-measuring device is considered to be properly positioned for yaw angle measurement. Make a mark, no wider than 1.6 mm (1/16 in.), on the probe sheath (or extension), such that the yaw angle-measuring device can be re-affixed at this same properly aligned position during the velocity traverse.

18.1.1.2 Procedure for probe extensions with scribe lines. If, during a velocity traverse the angle-measuring device will be affixed to a probe extension having a scribe line as specified in section 6.1.5.2, the following procedure may be used to align the extension's scribe line with the reference scribe line instead of marking the extension as described in section 18.1.1.1. Attach the probe extension to the main probe. Align and lock the second angle-measuring device on the probe extension's scribe line. Then, rotate the extension until both measuring devices indicate the same angle (±1°). Lock the extension at this rotational position. Record the angles indicated by the two angle-measuring devices on a form similar to table 2G-2. An angle-measuring device may be aligned at any position on this scribe line during the velocity traverse, if the scribe line meets the alignment specification in section 6.1.5.3.

18.1.1.3 Post-test rotational position check. If the fully assembled probe includes one or more extensions, the following check should be performed immediately after the completion of a velocity traverse. At the discretion of the tester, additional checks may be conducted after completion of testing at any sample port. Without altering the alignment of any of the components of the probe assembly used in the velocity traverse, secure the fully assembled probe in a horizontal position. Affix an angle-measuring device at the reference scribe line specified in section 6.1.5.1. Use the other angle-measuring device to check the angle at each location where the device was checked prior to testing. Record the readings from the two angle-measuring devices.

18.1.2 Rotational position check with probe in stack. This section applies only to probes that, due to physical constraints, cannot be inserted into the test port as fully assembled with all necessary extensions needed to reach the inner-most traverse point(s).

18.1.2.1 Perform the out-of-stack procedure in section 18.1.1 on the main probe and any attached extensions that will be initially inserted into the test port.

18.1.2.2 Use the following procedures to perform additional rotational position check(s) with the probe in the stack, each time a probe extension is added. Two angle-measuring devices are required. The first of these is the device that was used to measure yaw angles at the preceding traverse point, left in its properly aligned measurement position. The second angle-measuring device is positioned on the added probe extension. Use the applicable procedures in section 18.1.1.1 or 18.1.1.2 to align, adjust, lock, and mark (if necessary) the position of the second angle-measuring device to within ±1° of the first device. Record the readings of the two devices on a form similar to Table 2G–2.

18.1.2.3 The procedure in section 18.1.2.2 should be performed at the first port where measurements are taken. The procedure should be repeated each time a probe extension is re-attached at a subsequent port, unless the probe extensions are designed to be locked into a mechanically fixed rotational position (e.g., through use of interlocking grooves), which can be reproduced from port to port as specified in section 8.3.5.2.

18.2 Annex B—Angle Measurement Protocol for Protractor Wheel and Pointer Device. The following procedure shall be used when a protractor wheel and pointer assembly, such as the one described in section 6.2.2 and illustrated in Figure 2G–5 is used to measure the yaw angle of flow. With each move to a new traverse point, unlock, re-align, and re-lock the probe, angle-pointer collar, and protractor wheel to each other. At each such move, particular attention is required to ensure that the scribe line on the angle pointer collar is either aligned with the reference scribe line on the main probe sheath or is at the rotational offset position established under section 8.3.1. The procedure consists of the following steps:

18.2.1 Affix a protractor wheel to the entry port for the test probe in the stack or duct.

18.2.2 Orient the protractor wheel so that the 0° mark corresponds to the longitudinal axis of the stack or duct. For stacks, vertical ducts, or ports on the side of horizontal ducts, use a digital inclinometer meeting the specifications in section 6.2.1 to locate the 0° orientation. For ports on the top or bottom of horizontal ducts, identify the longitudinal axis at each test port and permanently mark the duct to indicate the 0° orientation. Once the protractor wheel is properly aligned, lock it into position on the test port.

18.2.3 Move the pointer assembly along the probe sheath to the position needed to take measurements at the first traverse point. Align the scribe line on the pointer collar with the reference scribe line or at the rotational offset position established under section 8.3.1. Maintaining this rotational alignment, lock the pointer device onto the probe sheath. Insert the probe into the entry port to the depth needed to take measurements at the first traverse point.

18.2.4 Perform the yaw angle determination as specified in sections 8.9.3 and 8.9.4 and record the angle as shown by the pointer on the protractor wheel. Then, take velocity pressure and temperature measurements in accordance with the procedure in section 8.9.5. Perform the alignment check described in section 8.9.6.

18.2.5 After taking velocity pressure measurements at that traverse point, unlock the probe from the collar and slide the probe through the collar to the depth needed to reach the next traverse point.

18.2.6 Align the scribe line on the pointer collar with the reference scribe line on the main probe or at the rotational offset position established under section 8.3.1. Lock the collar onto the probe.

18.2.7 Repeat the steps in sections 18.2.4 through 18.2.6 at the remaining traverse points accessed from the current stack or duct entry port.

18.2.8 After completing the measurement at the last traverse point accessed from a port, verify that the orientation of the protractor wheel on the test port has not changed over the course of the traverse at that port. For stacks, vertical ducts, or ports on the side of horizontal ducts, use a digital inclinometer meeting the specifications in section 6.2.1 to check the rotational position of the 0° mark on the protractor wheel. For ports on the top or bottom of horizontal ducts, observe the alignment of the angle wheel 0° mark relative to the permanent 0° mark on the duct at that test port. If these observed comparisons exceed ±2° of 0°, all angle and pressure measurements taken at that port since the protractor wheel was last locked into position on the port shall be repeated.

18.2.9 Move to the next stack or duct entry port and repeat the steps in sections 18.2.1 through 18.2.8.

18.3 Annex C—Guideline for Reference Scribe Line Placement. Use of the following guideline is recommended to satisfy the requirements of section 10.4 of this method. The rotational position of the reference scribe line should be either 90° or 180° from the probe's impact pressure port. For Type-S probes, place separate scribe lines, on opposite sides of the probe sheath, if both the A and B sides of the pitot tube are to be used for yaw angle measurements.

18.4 Annex D—Determination of Reference Scribe Line Rotational Offset. The following procedures are recommended for determining the magnitude and sign of a probe's reference scribe line rotational offset, R_{SLO}. Separate procedures are provided for two types of angle-measuring devices: digital inclinometers and protractor wheel and pointer assemblies.

18.4.1 Perform the following procedures on the main probe with all devices that will be attached to the main probe in the field [such as thermocouples, resistance temperature detectors (RTDs), or sampling nozzles] that may affect the flow around the probe head. Probe shaft extensions that do not affect flow around the probe head need not be attached during calibration.

18.4.2 The procedures below assume that the wind tunnel duct used for probe calibration is horizontal and that the flow in the calibration wind tunnel is axial as determined by the axial flow verification check described in section 10.1.2. Angle-measuring devices are assumed to display angles in alternating 0° to 90° and 90° to 0° intervals. If angle-measuring devices with other readout conventions are used or if other calibration wind tunnel duct configurations are used, make the appropriate calculational corrections. For Type-S probes, calibrate the A-side and B-sides separately, using the appropriate scribe line (see section 18.3, above), if both the A and B sides of the pitot tube are to be used for yaw angle determinations.

18.4.2.1 Position the angle-measuring device in accordance with one of the following procedures.

18.4.2.1.1 If using a digital inclinometer, affix the calibrated digital inclinometer to the probe. If the digital inclinometer can be independently adjusted after being locked into position on the probe sheath (e.g., by means of a set screw), the independent adjustment must be set so that the device performs exactly like a device without the capability for independent adjustment. That is, when aligned on the probe the device must give the same readings as a device that does not have the capability of being independently adjusted. Either align it directly on the reference scribe line or on a mark aligned with the scribe line determined according to the procedures in section 18.1.1.1. Maintaining this rotational alignment, lock the digital inclinometer onto the probe sheath.

18.4.2.1.2 If using a protractor wheel and pointer device, orient the protractor wheel on the test port so that the ° mark is aligned with the longitudinal axis of the wind tunnel duct. Maintaining this alignment, lock the wheel into place on the wind tunnel test port. Align the scribe line on the pointer collar with the reference scribe line or with a mark aligned with the reference scribe line, as determined under section 18.1.1.1. Maintaining this rotational alignment, lock the pointer device onto the probe sheath.

18.4.2.2 Zero the pressure-measuring device used for yaw nulling.

18.4.2.3 Insert the probe assembly into the wind tunnel through the entry port, positioning the probe's impact port at the calibration location. Check the responsiveness of the pressure-measuring device to probe rotation, taking corrective action if the response is unacceptable.

18.4.2.4 Ensure that the probe is in a horizontal position using a carpenter's level.

18.4.2.5 Rotate the probe either clockwise or counterclockwise until a yaw null [zero ΔP for a Type S probe or zero (P_2-P_3) for a 3–D probe] is obtained. If using a Type S probe with an attached thermocouple, the direction of the probe rotation shall be such that the thermocouple is located downstream of the probe pressure ports at the yaw-null position.

18.4.2.6 Read and record the value of θ_{null}, the angle indicated by the angle-measuring device at the yaw-null position. Record the angle reading on a form similar to Table 2G–6. Do not associate an algebraic sign with this reading.

18.4.2.7 Determine the magnitude and algebraic sign of the reference scribe line rotational offset, R_{SLO}. The magnitude of R_{SLO} will be equal to either θ_{null} or $(90°-\theta_{null})$, depending on the type of probe being calibrated and the type of angle-measuring device used. (See Table 2G–7 for a summary.) The algebraic sign of R_{SLO} will either be positive if the rotational position of the reference scribe line is clockwise or negative if counterclockwise with respect to the probe's yaw-null position. Figure 2G–10 illustrates how the magnitude and sign of R_{SLO} are determined.

18.4.2.8 Perform the steps in sections 18.3.2.3 through 18.3.2.7 twice at each of the two calibration velocities selected for the probe under section 10.6. Record the values of R_{SLO} in a form similar to Table 2G–6.

18.4.2.9 The average of all R_{SLO} values is the reference scribe line rotational offset for the probe.

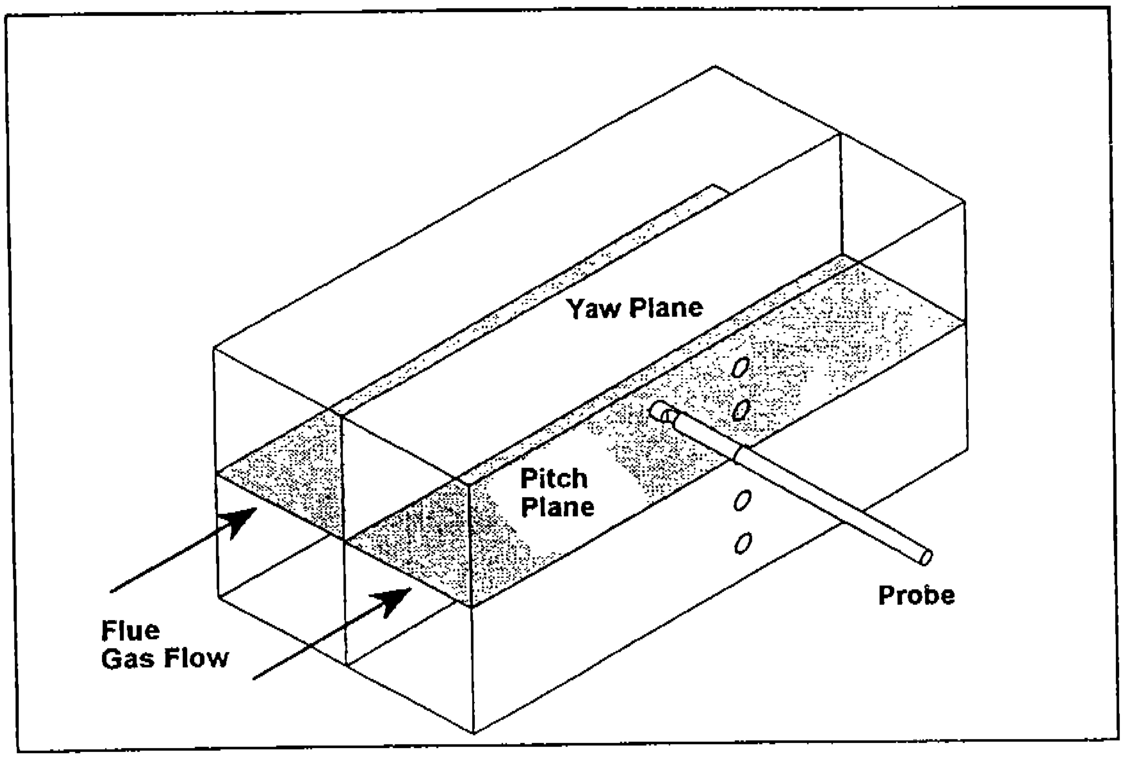


Figure 2G-1. Illustration of yaw and pitch planes in stack or duct.

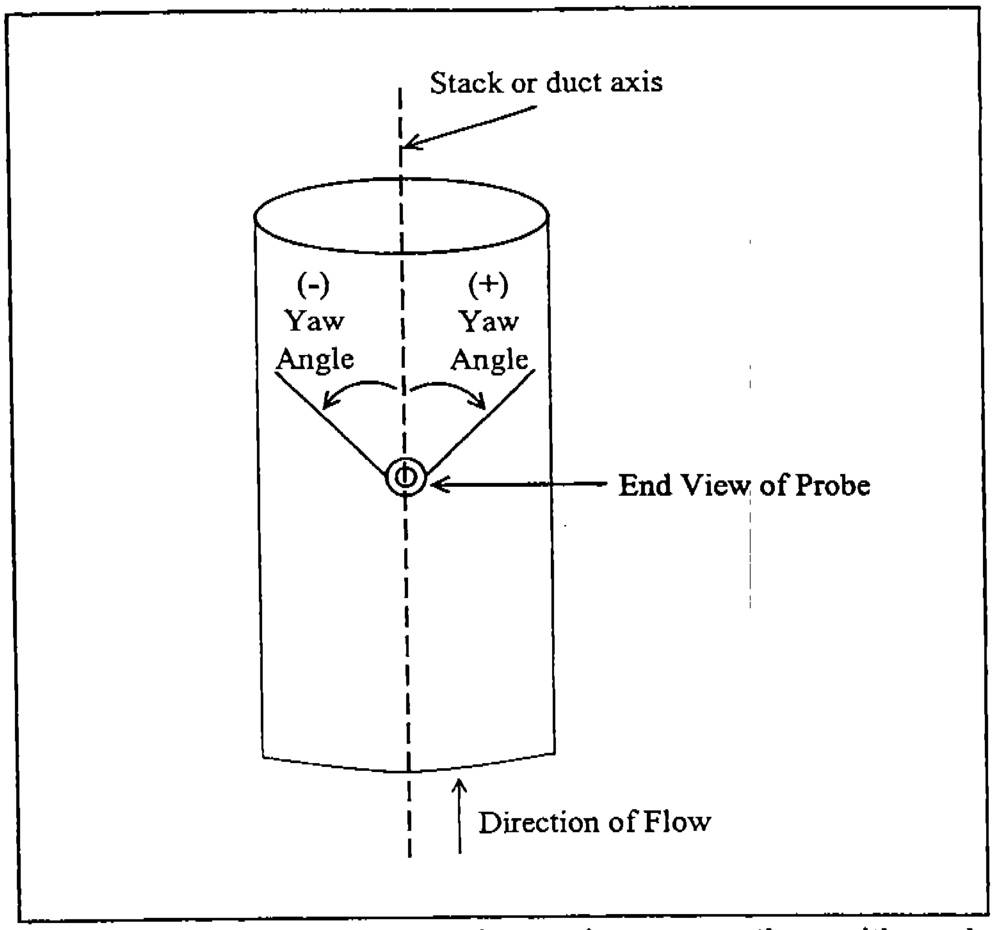


Figure 2G-2. Illustration of probe rotation representing positive and negative yaw angles.

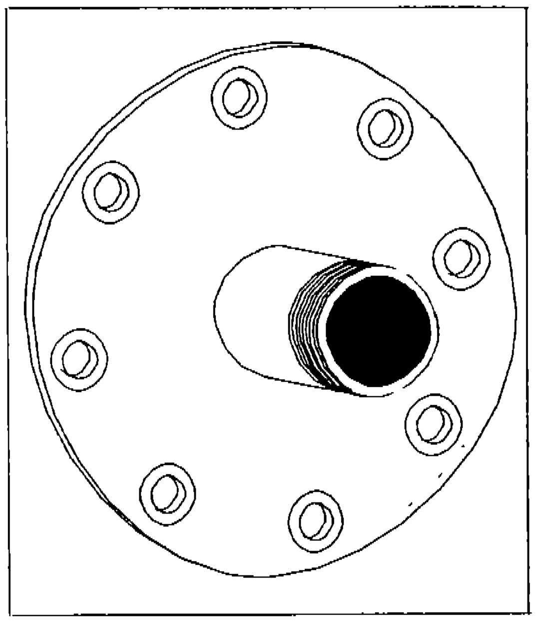


Figure 2G-3. Example bushing sleeve.

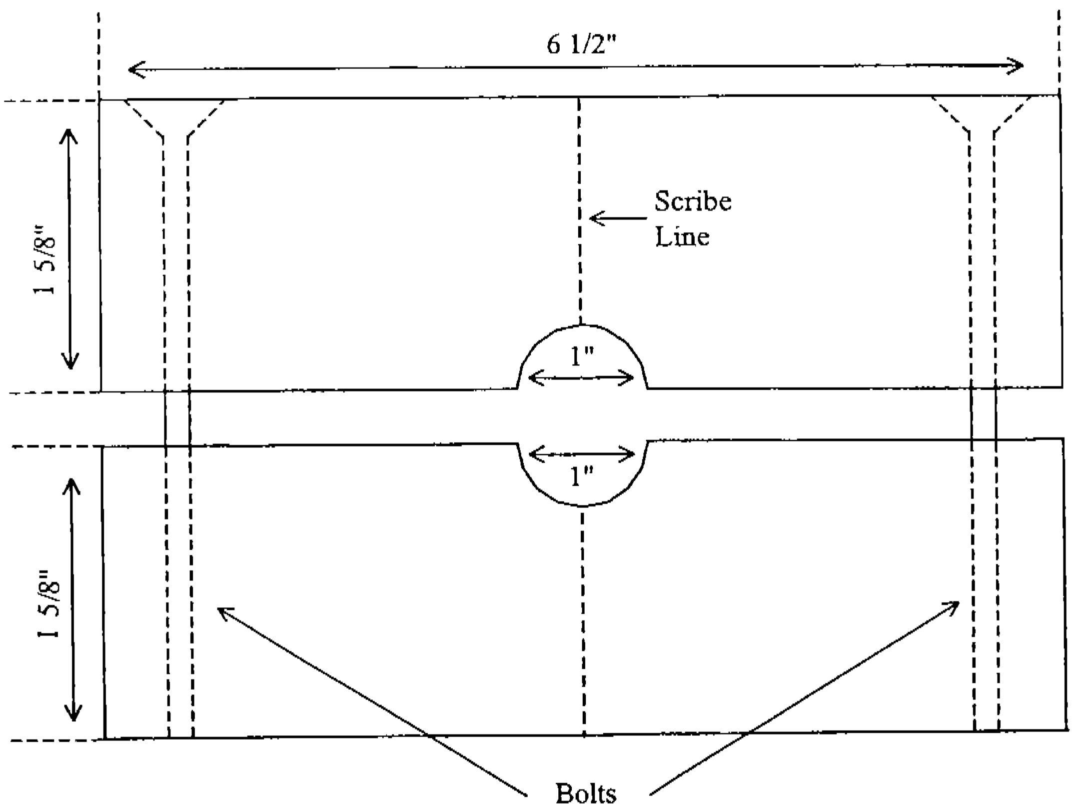


Figure 2G-4. Rotational position collar block.

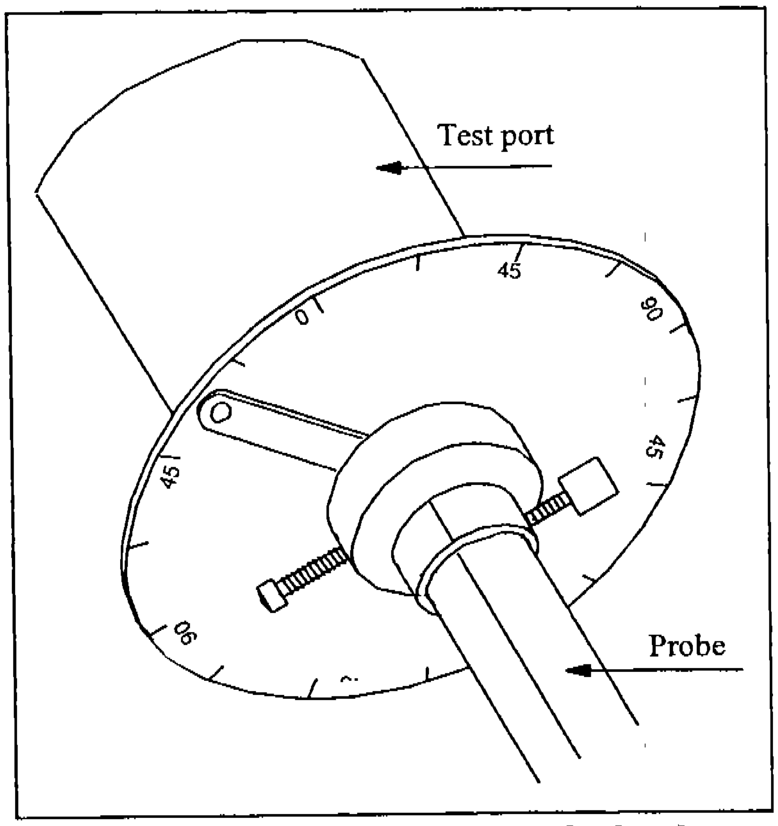


Figure 2G-5. Yaw angle protractor wheel and pointer.

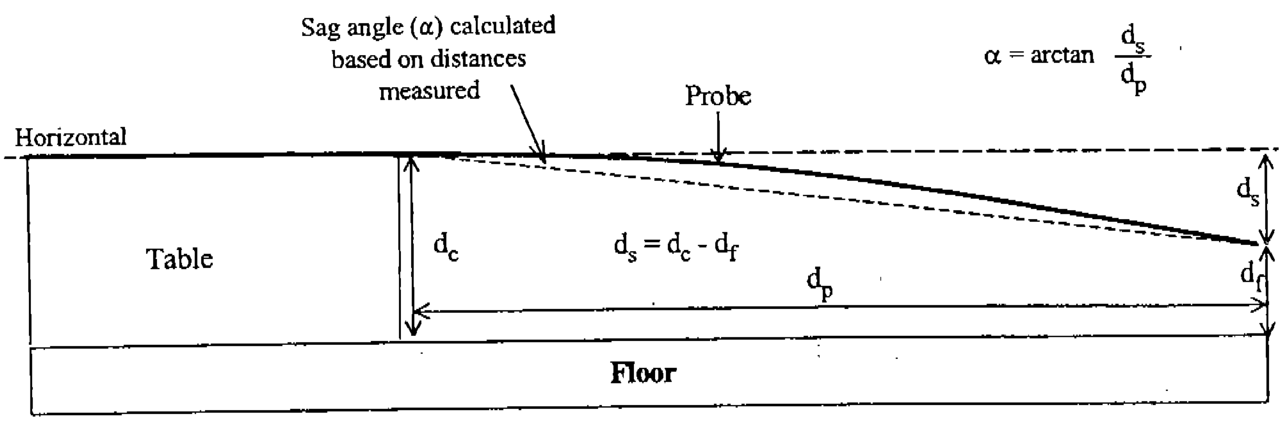


Figure 2G-6. Elements in horizontal straightness test based on trigonometry.

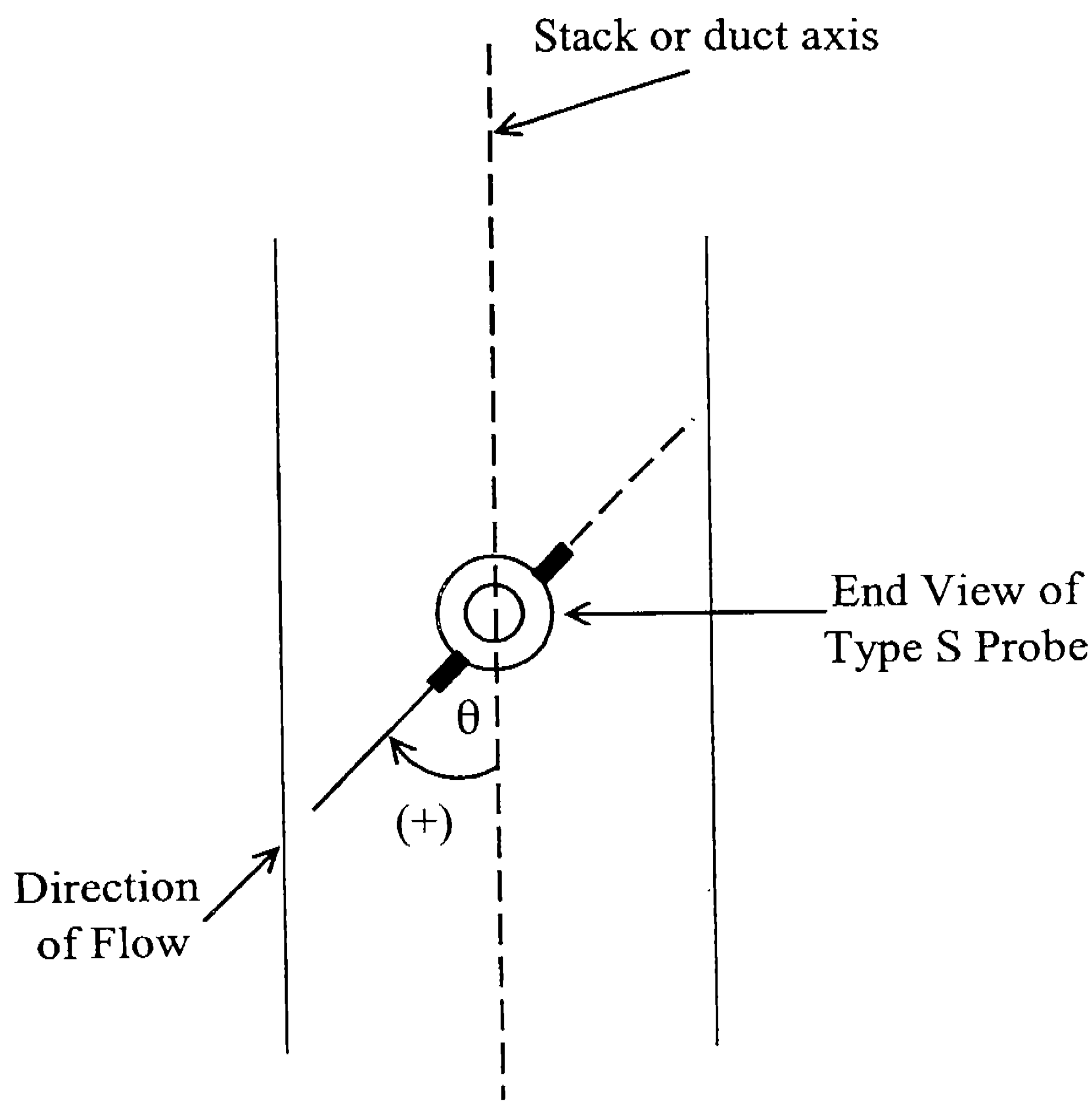


Figure 2G-7. Sign convention for the measured angle (θ) when the probe impact port is pointed directly into the flow. The angle θ is positive when the probe's impact pressure port is oriented in a clockwise rotational position relative to the stack or duct axis, as shown above, and negative for a counter-clockwise orientation.

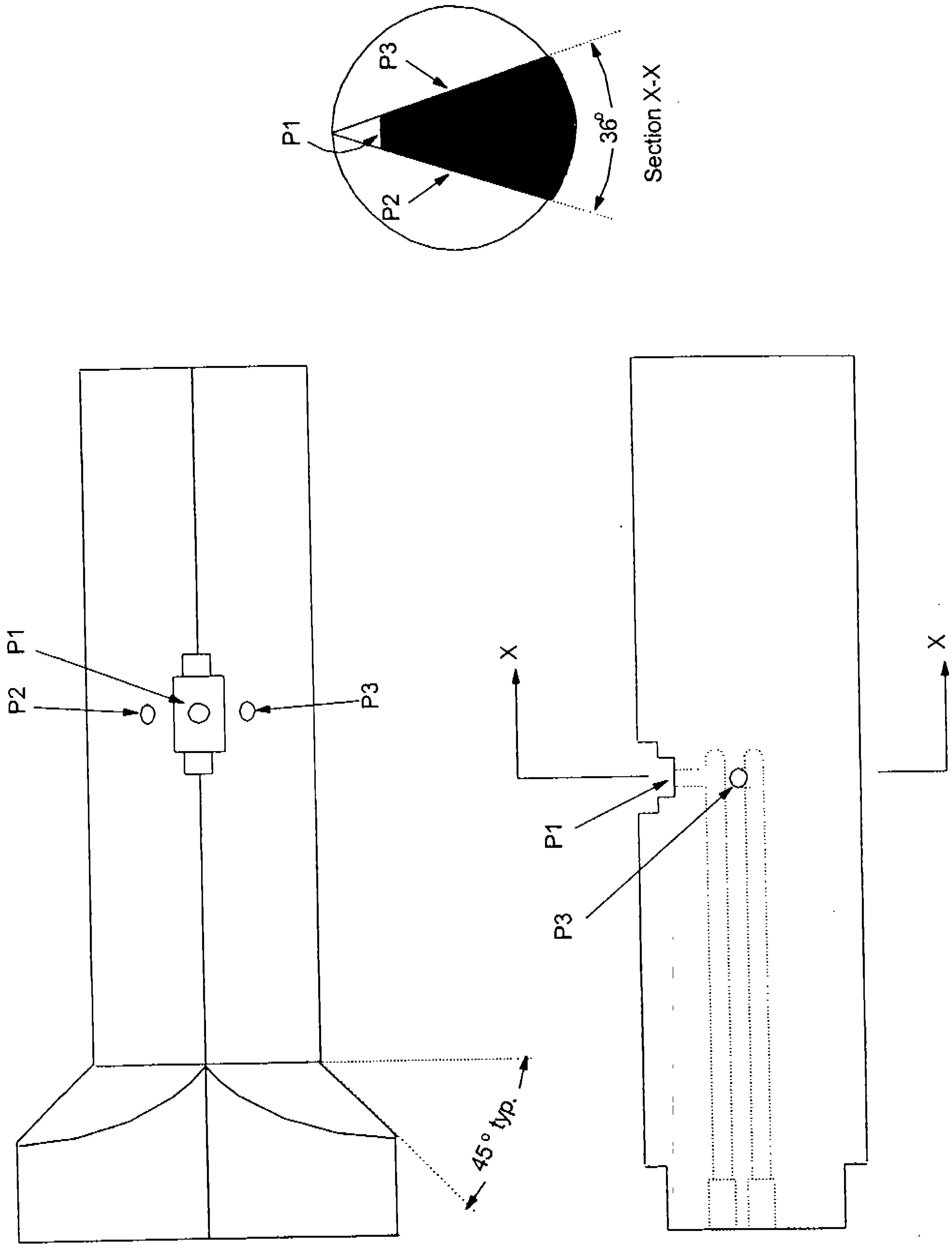


Figure 2G-8. Wedge probe used for axial flow verification.

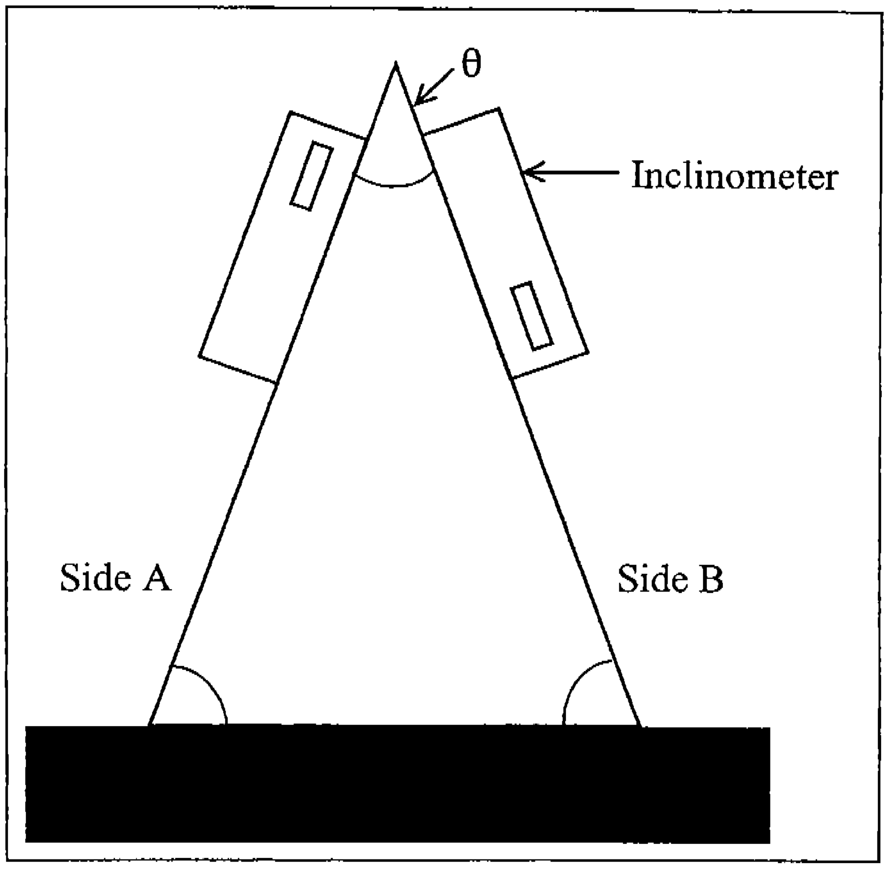


Figure 2G-9. Triangular block used for digital inclinometer calibration.

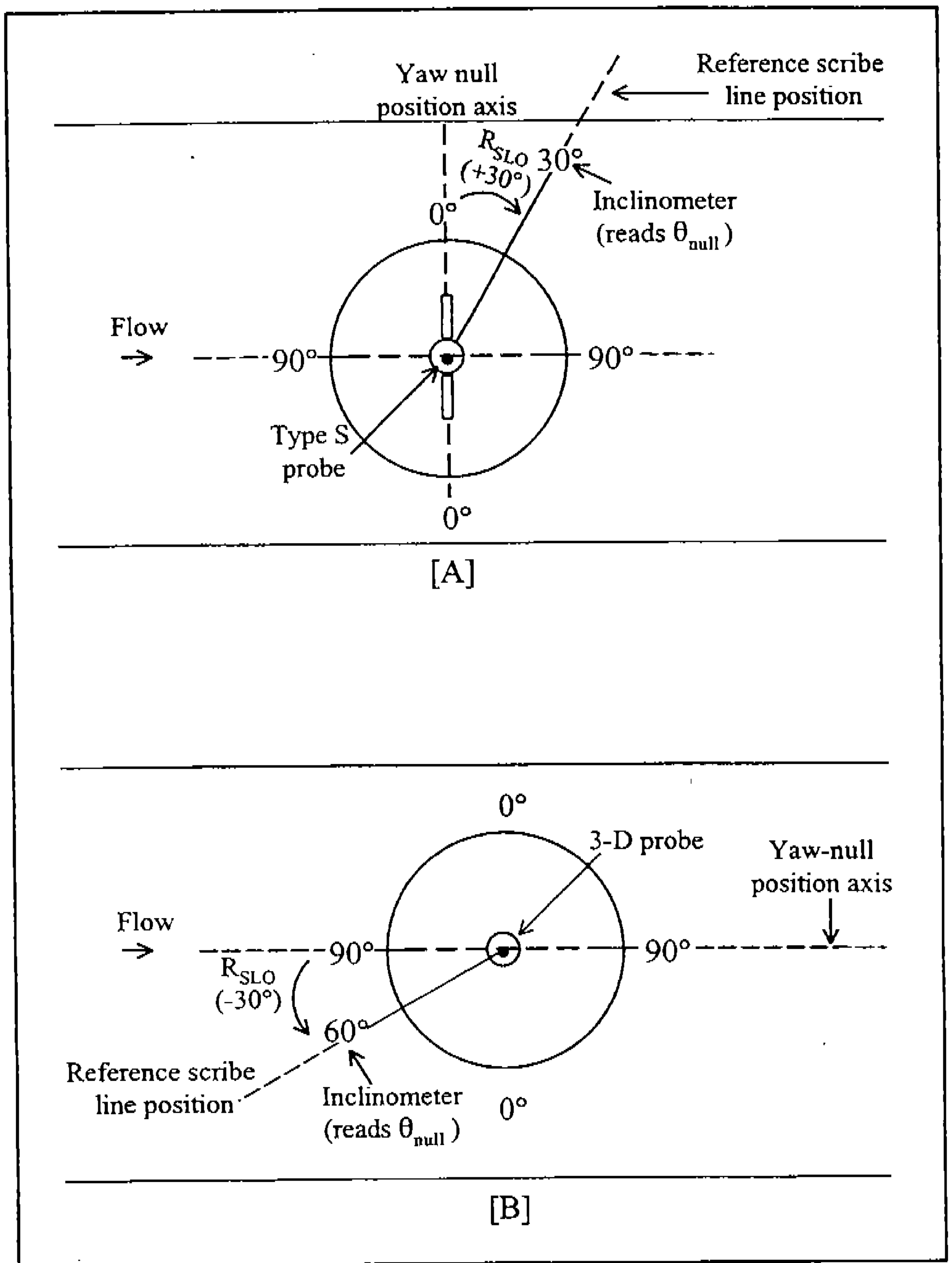
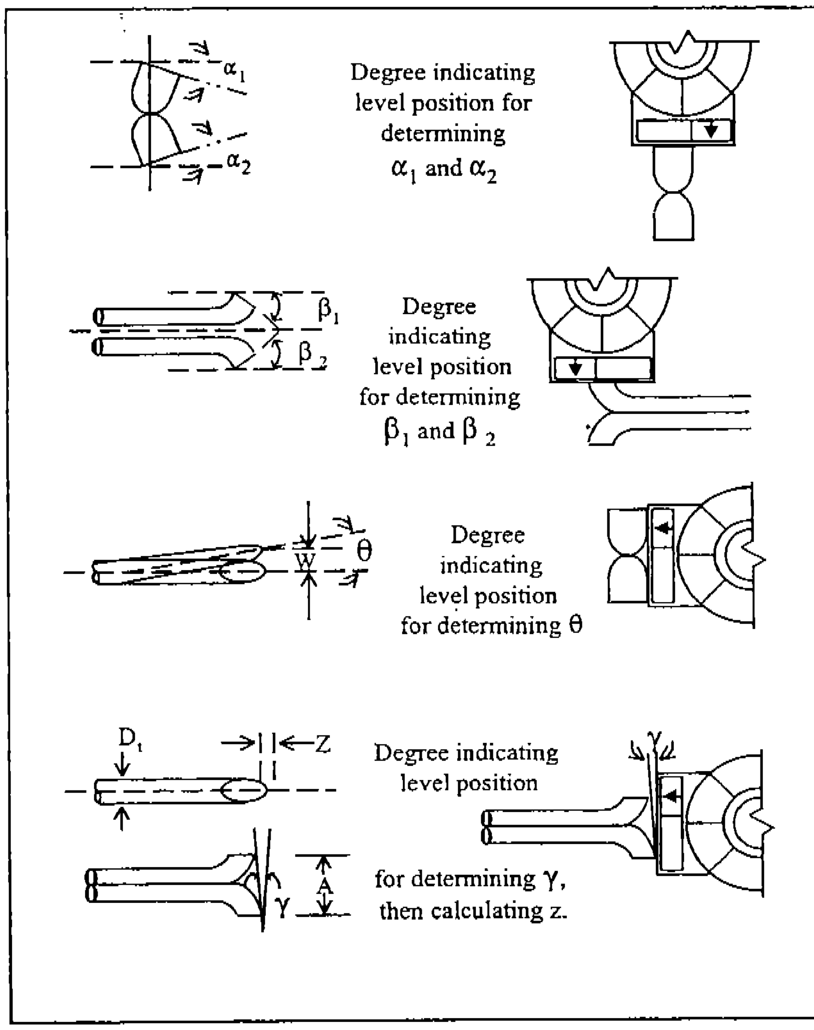


Figure 2G-10. Determination of reference scribe line rotational offset (R_{SLO}) in a horizontal wind tunnel with axial flow for: [A], a Type S probe, and [B], a 3-D probe. In [A] and [B], the probe impact pressure port is aligned with the yaw-null position axis and the inclinometer reads θ_{null}. In [A], the magnitude of $R_{SLO} = \theta_{null}$ and the sign is positive (clockwise from yaw-null position axis). In [B], the magnitude of $R_{SLO} = 90°-\theta_{null}$ and the sign is negative (counterclockwise from yaw-null position axis).

Table 2G-1. Type S Probe Inspection Sheet

Note: Method 2 provides the criteria for an acceptably constructed Type S pitot tube. However, the procedure for making the necessary measurements is not specified. One approach is given below.

1. Use a vise with parallel and perpendicular faces. Use an angle-measuring device (analog or digital) for this check.
2. Place the pitot tube in the vise, and level the pitot tube horizontally using the angle-measuring device.
3. Place the angle-measuring device as shown below.
4. Measure distance A, which is P_A plus P_B. Method 2 specifies that $P_A = P_B$, but provides no tolerance for this measurement. Because this measurement is very difficult, it is suggested that $P_A = P_B = A/2$.
5. Measure the external tube diameter (D_t) with a micrometer, machinist's rule, or internal caliper.
6. Record all data as shown on the form below.
7. Calculate dimensions w and z as shown below.



Level and perpendicular?	
Obstruction?	
Damaged?	
α_1 $(-2° \le \alpha_1 \le +2°)$	
α_2 $(-2° \le \alpha_2 \le +2°)$	
β_1 $(-2° \le \beta_1 \le +2°)$	
β_2 $(-2° \le \beta_2 \le +2°)$	
γ	
θ	
$z = A(\tan\gamma)$ [≤ 0.5 mm (0.02 in.)]	
$w = A(\tan\theta)$ [≤ 0.5 mm (0.02 in.)]	
D_t [≥ 9.5 mm (3/8 in.)]	
A	
$A/2D_t$ $(1.05 \le P_A/D_t \le 1.5)$ *	
* Recommended dimensions	

QA/QC Check

Completeness__________ Legibility__________ Accuracy__________

Specifications__________ Reasonableness__________

Certification

I certify that the Type S probe ID _______ meets or exceeds all specifications, criteria, and applicable design features.

Certified by:____________________ Date:__________

Table 2G-2. Rotational Position Check

Source:__________ Date:__________

Test Location:__________ Tester(s):__________

Probe Type:__________ Affiliation:__________

Probe ID:__________ Fully-Assembled Probe Length in mm (in.):__________

Position	Angle Comparisons		
Distance of 2nd measurement device from probe head impact port in mm (in.)	1st Device Angle measured by device aligned on the reference scribe line, including algebraic sign (degrees)	2nd Device Angle measured by device mounted at each position to be used during testing, including algebraic sign (degrees)	R_{ADO} Difference between readings by 1st and 2nd angle-measuring devices (degrees)[a]
(Col. A)	(Col. B)	(Col. C)	(Col. C - Col. B)

[a] The algebraic sign must be consistent with section 8.3.2.

Specifications: For the pre-test rotational position check, the value of R_{ADO} at each location along the probe shaft must be determined to within ±1°. In the post-test check, R_{ADO} at each location must remain within ±2° of the value obtained in the pre-test check.

Table 2G-3. Example EPA Method 2G Field Data Form

Source: ______________________ Date: ______________________

Source Location: ______________________ Test Personnel: ______________________

Measurement Location: ______________________ Probe Type: ______________________

Run ID:	
Start Time:	
End Time:	
Pitot Tube ID:	
Pitot Tube Coefficient (C_p):	
Pressure Gauge ID:	
Pressure Gauge Readability:	in. H_2O
Temperature Gauge ID:	
Measurement System Response Time	sec.

Stack Diameter:		
Stack Area:		
Barometric Pressure (P_{bar}):	in. Hg	
Static Pressure (P_s):	in. H_2O	
R_{SLO}		
R_{ADO}		
	Pre-test	Post-test
Pitot Tube Condition: Damage Noted?		
Leak Check Performed?		

Clock Time	Traverse Point	Yaw Angle, including algebraic sign (degrees)	Differential Pressure (Δ P)	Stack or Duct Gas Temperature (° F)

Table 2G-4. Wind Tunnel Velocity Pressure Cross-Check

Wind Tunnel Facility: ______________________

Date: ______________________

Wind Tunnel Temperature: ______________________

Barometric Pressure: ______________________

Test Point Locations: ______________________

Lowest Test Velocity in m/sec (ft/sec): ______________________

Highest Test Velocity in m/sec (ft/sec): ______________________

Port		Rep.	Velocity Pressure (ΔP_{std})	
			@ Lowest Test Velocity	@ Highest Test Velocity
Calibration Pitot Tube Location		1		
		2		
		3		
		Average		
Calibration Location Test Points *	1	1		
		2		
		3		
		Average		
		% Difference **		
	2	1		
		2		
		3		
		Average		
		% Difference **		
	..	1		
		2		
		3		
		Average		
		% Difference **		

* Measurements must be taken at all points in the calibration location as specified in section 10.1.1

** Percent Difference = $\dfrac{(\textit{Calibration Location Test Point Avg} - \textit{Cal. Pitot Tube Location Avg})}{\textit{Cal. Pitot Tube Location Avg}} \times 100\%$

Specification: At each velocity setting, the average velocity pressure obtained at the calibration location shall be within ±2 percent or 0.01 in. H_2O, whichever is less restrictive, of the average velocity pressure obtained at the fixed calibration pitot tube location.

Table 2G-5. Wind Tunnel Axial Flow Verification

Wind Tunnel Facility: ______________________________
Date: ______________________________
Wind Tunnel Temperature: ______________________________
Barometric Pressure: ______________________________
Probe Type/I.D. Used To Conduct Check: ______________________________
Test Point Locations: ______________________________
Lowest Test Velocity in m/sec (ft/sec): ______________________________
Highest Test Velocity in m/sec (ft/sec): ______________________________

Port		@ Lowest Test Velocity		@ Highest Test Velocity	
		Yaw Angle * (degrees)	Pitch Angle * (degrees)	Yaw Angle * (degrees)	Pitch Angle * (degrees)
Calibration Location Test Points **	1				
	2				
	3				
	..				
Calibration Pitot Tube Location					

* When following the procedures in section 10.1.2.1, both the yaw and pitch angles are obtained from the same port. When following the procedures in section 10.1.2.2, the yaw angle is obtained using the port for the tested probe, and the pitch angle is obtained using the port for verification of axial flow.

** Yaw and pitch angle measurements must be taken at all points that define the calibration location (as per the requirements in section 10.1.1)

Specification: At each velocity setting, each measured yaw and pitch angle shall be within ±3° of 0° in accordance with the requirements in section 10.1.2.

Table 2G-6. Yaw Angle Calibration

Probe Type: ____________ **Tester(s):** ____________

Probe ID: ____________ **Affiliation:** ____________

Test Location: ____________ **Date:** ____________

	Repetition 1		Repetition 2	
Nominal Velocity Setting in m/sec (ft/sec)	θ_{null} (degrees)	R_{SLO} (degrees)*	θ_{null} (degrees)	R_{SLO} (degrees)*
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______

Average of all recorded R_{SLO} values: ______

* Include magnitude and algebraic sign in accordance with section 10.5.6.

Table 2G-7. Determining the Magnitude of Reference Scribe Line Offset

Probe/Angle-Measuring Device	Magnitude of R_{SLO}
Type S probe with inclinometer	θ_{null}
Type S probe with protractor wheel and pointer	$90° - \theta_{null}$
3-D probe with inclinometer	$90° - \theta_{null}$
3-D probe with protractor wheel and pointer	θ_{null}

Table 2G-8. Probe Calibration for Method 2G

Wind Tunnel Facility: ____________________

Wind Tunnel Location: ____________________

Probe Type: ____________________

Probe ID: ____________________

Probe Calibration Date: ____________________

Test Point Location: ____________________

Ambient Temperature (°F): ____________________

Barometric Pressure (P_{bar}): ____________________

Repetition	Low Velocity Setting (ft/sec)	Calibration Pitot		Tested Probe		Calculated C_p or F_2
		ΔP_{std} (in. H_2O)	Temp. (°F)	ΔP or P_1-P_2 (in. H_2O)	Yaw Angle (°)	
1						
2						
3						
					Average ($C_{p(avg\text{-}low)}$) =	

Repetition	High Velocity Setting (ft/sec)	Calibration Pitot		Tested Probe		Calculated C_p or F_2
		ΔP_{std} (in. H_2O)	Temp. (°F)	ΔP or P_1-P_2 (in. H_2O)	Yaw Angle (°)	
1						
2						
3						
					Average ($C_{p(avg\text{-}high)}$) =	

$$\% \text{ Difference} = \frac{C_{p(avg-low)} - C_{p(avg-high)}}{C_{p(avg-low)}} \times 100\% = \_\_\_\_\_\_\%$$

Note: (1) The percent difference between the low and high velocity setting C_p values shall be within ±3 percent.

(2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

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Method 2H—Determination of Stack Gas Velocity Taking Into Account Velocity Decay Near the Stack Wall

1.0 Scope and Application

1.1 This method is applicable in conjunction with Methods 2, 2F, and 2G (40 CFR Part 60, Appendix A) to account for velocity decay near the wall in circular stacks and ducts.

1.2 This method is not applicable for testing stacks and ducts less than 3.3 ft (1.0 m) in diameter.

1.3 Data Quality Objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method

2.1 A wall effects adjustment factor is determined. It is used to adjust the average stack gas velocity obtained under Method 2, 2F, or 2G of this appendix to take into account velocity decay near the stack or duct wall.

2.2 The method contains two possible procedures: a calculational approach which derives an adjustment factor from velocity measurements and a default procedure which assigns a generic adjustment factor based on the construction of the stack or duct.

2.2.1 The calculational procedure derives a wall effects adjustment factor from velocity measurements taken using Method 2, 2F, or 2G at 16 (or more) traverse points specified under Method 1 of this appendix and a total of eight (or more) wall effects traverse points specified under this method. The calculational procedure based on velocity measurements is not applicable for horizontal circular ducts where build-up of particulate matter or other material in the bottom of the duct is present.

2.2.2 A default wall effects adjustment factor of 0.9900 for brick and mortar stacks and 0.9950 for all other types of stacks and ducts may be used without taking wall effects measurements in a stack or duct.

2.3 When the calculational procedure is conducted as part of a relative accuracy test audit (RATA) or other multiple-run test procedure, the wall effects adjustment factor derived from a single traverse (i.e., single RATA run) may be applied to all runs of the same RATA without repeating the wall effects measurements. Alternatively, wall effects adjustment factors may be derived for several traverses and an average wall effects adjustment factor applied to all runs of the same RATA.

3.0 Definitions.

3.1 Complete wall effects traverse means a traverse in which measurements are taken at d_{rem} (see section 3.3) and at 1-in. intervals in each of the four Method 1 equal-area sectors closest to the wall, beginning not farther than 4 in. (10.2 cm) from the wall and extending either (1) across the entire width of the Method 1 equal-area sector or (2) for stacks or ducts where this width exceeds 12 in. (30.5 cm) (i.e., stacks or ducts greater than or equal to 15.6 ft [4.8 m] in diameter), to a distance of not less than 12 in. (30.5 cm) from the wall. Note: Because this method specifies that measurements must be taken at whole number multiples of 1 in. from a stack or duct wall, for clarity numerical quantities in this method are expressed in English units followed by metric units in parentheses. To enhance readability, hyphenated terms such as "1-in. intervals" or "1-in. incremented," are expressed in English units only.

3.2 d_{last}. Depending on context, d_{last} means either (1) the distance from the wall of the last 1-in. incremented wall effects traverse point or (2) the traverse point located at that distance (see Figure 2H–2).

3.3 d_{rem}. Depending on context, d_{rem} means either (1) the distance from the wall of the centroid of the area between d_{last} and the interior edge of the Method 1 equal-area sector closest to the wall or (2) the traverse point located at that distance (see Figure 2H–2).

3.4 *"May," "Must," "Shall," "Should,"* and the imperative form of verbs.

3.4.1 *"May"* is used to indicate that a provision of this method is optional.

3.4.2 *"Must," "Shall,"* and the imperative form of verbs (such as "record" or "enter") are used to indicate that a provision of this method is mandatory.

3.4.3 *"Should"* is used to indicate that a provision of this method is not mandatory but is highly recommended as good practice.

3.5 *Method 1* refers to 40 CFR part 60, appendix A, "Method 1—Sample and velocity traverses for stationary sources."

3.6 *Method 1 exterior equal-area sector and Method 1 equal-area sector closest to the wall* mean any one of the four equal-area sectors that are closest to the wall for a circular stack or duct laid out in accordance with section 2.3.1 of Method 1 (see Figure 2H–1).

3.7 *Method 1 interior equal-area sector* means any of the equal-area sectors other than the Method 1 exterior equal-area sectors (as defined in section 3.6) for a circular stack or duct laid out in accordance with section 2.3.1 of Method 1 (see Figure 2H–1).

3.8 *Method 1 traverse point and Method 1 equal-area traverse point* mean a traverse point located at the centroid of an equal-area sector of a circular stack laid out in accordance with section 2.3.1 of Method 1.

3.9 *Method 2* refers to 40 CFR part 60, appendix A, "Method 2—Determination of stack gas velocity and volumetric flow rate (Type S pitot tube)."

3.10 *Method 2F* refers to 40 CFR part 60, appendix A, "Method 2F—Determination of stack gas velocity and volumetric flow rate with three-dimensional probes."

3.11 *Method 2G* refers to 40 CFR part 60, appendix A, "Method 2G—Determination of stack gas velocity and volumetric flow rate with two-dimensional probes."

3.12 *1-in. incremented wall effects traverse point* means any of the wall effects traverse points that are located at 1-in. intervals, i.e., traverse points d_1 through d_{last} (see Figure 2H–2).

3.13 *Partial wall effects traverse* means a traverse in which measurements are taken at fewer than the number of traverse points required for a "complete wall effects traverse" (as defined in section 3.1), but are taken at a minimum of two traverse points in each Method 1 equal-area sector closest to the wall, as specified in section 8.2.2.

3.14 *Relative accuracy test audit (RATA)* is a field test procedure performed in a stack or duct in which a series of concurrent measurements of the same stack gas stream is taken by a reference method and an installed monitoring system. A RATA usually consists of series of 9 to 12 sets of such concurrent measurements, each of which is referred to as a RATA run. In a volumetric flow RATA, each reference method run consists of a complete traverse of the stack or duct.

3.15 *Wall effects-unadjusted average velocity* means the average stack gas velocity, not accounting for velocity decay near the wall, as determined in accordance with Method 2, 2F, or 2G for a Method 1 traverse consisting of 16 or more points.

3.16 *Wall effects-adjusted average velocity* means the average stack gas velocity, taking into account velocity decay near the wall, as calculated from measurements at 16 or more Method 1 traverse points and at the additional wall effects traverse points specified in this method.

3.17 *Wall effects traverse point* means a traverse point located in accordance with sections 8.2.2 or 8.2.3 of this method.

4.0 Interferences. [Reserved]

5.0 Safety

5.1 This method may involve hazardous materials, operations, and equipment. This method does not purport to address all of the health and safety considerations associated with its use. It is the responsibility of the user of this method to establish appropriate health and safety practices and to determine the applicability of occupational health and safety regulatory requirements prior to performing this method.

6.0 Equipment and Supplies

6.1 The provisions pertaining to equipment and supplies in the method that is used to take the traverse point measurements (i.e., Method 2, 2F, or 2G) are applicable under this method.

7.0 Reagents and Standards. [Reserved]

8.0 Sample Collection and Analysis

8.1 Default Wall Effects Adjustment Factors. A default wall effects adjustment factor of 0.9900 for brick and mortar stacks and 0.9950 for all other types of stacks and ducts may be used without conducting the following procedures.

8.2 Traverse Point Locations. Determine the location of the Method 1 traverse points in accordance with section 8.2.1 and the location of the traverse points for either a partial wall effects traverse in accordance with section 8.2.2 or a complete wall effects traverse in accordance with section 8.2.3.

8.2.1 Method 1 equal-area traverse point locations. Determine the location of the Method 1 equal-area traverse points for a traverse consisting of 16 or more points using Table 1–2 (Location of Traverse Points in Circular Stacks) of Method 1.

8.2.2 Partial wall effects traverse. For a partial wall effects traverse, measurements must be taken at a minimum of the following two wall effects traverse point locations in all four Method 1 equal-area sectors closest to the wall: (1) 1 in. (2.5 cm) from the wall (except as provided in section 8.2.2.1) and (2)

d_{rem}, as determined using Equation 2H–1 or 2H–2 (see section 8.2.2.2).

8.2.2.1 If the probe cannot be positioned at 1 in. (2.5 cm) from the wall (e.g., because of insufficient room to withdraw the probe shaft) or if velocity pressure cannot be detected at 1 in. (2.5 cm) from the wall (for any reason other than build-up of particulate matter in the bottom of a duct), take measurements at the 1-in. incremented wall effects traverse point closest to the wall where the probe can be positioned and velocity pressure can be detected.

8.2.2.2 Calculate the distance of d_{rem} from the wall to within ±¼ in. (6.4 mm) using Equation 2H–1 or Equation 2H–2 (for a 16-point traverse).

$$d_{last} \le d_b \qquad \text{Eq. 2H-3}$$

Where:

r = the stack or duct radius determined from direct measurement of the stack or duct diameter in accordance with section 8.6 of Method 2F or Method 2G, in. (cm);

p = the number of Method 1 equal-area traverse points on a diameter, $p \ge 8$ (e.g., for a 16-point traverse, p = 8); d_{last} and d_{rem} are defined in sections 3.2 and 3.3 respectively, in. (cm).

For a 16-point Method 1 traverse, Equation 2H–1 becomes:

$$d_{rem} = r - \sqrt{\frac{7}{8}r^2 - rd_{last} + \frac{1}{2}d_{last}^2} \qquad \text{Eq. 2H-2}$$

8.2.2.3 Measurements may be taken at any number of additional wall effects traverse points, with the following provisions.

(a) d_{last} must not be closer to the center of the stack or duct than the distance of the interior edge (boundary), d_b, of the Method 1 equal-area sector closest to the wall (see Figure 2H–2 or 2H–3). That is,

$$d_b = r\left(1 - \sqrt{1 - \frac{2}{p}}\right) \qquad \text{Eq. 2H-4}$$

Where:

$$d_b = r\left(1 - \sqrt{1 - \frac{2}{p}}\right) \qquad \text{Eq. 2H-4}$$

Table 2H–1 shows d_b as a function of the stack or duct radius, r, for traverses ranging from 16 to 48 points (i.e., for values of p ranging from 8 to 24).

(b) Each point must be located at a distance that is a whole number (e.g., 1, 2, 3) multiple of 1 in. (2.5 cm).

(c) Points do not have to be located at consecutive 1-in. intervals. That is, one or more 1-in. incremented points may be skipped. For example, it would be acceptable for points to be located at 1 in. (2.5 cm), 3 in. (7.6 cm), 5 in. (12.7 cm), d_{last}, and d_{rem}; or at 1 in. (2.5 cm), 2 in. (5.1 cm), 4 in. (10.2 cm), 7 in. (17.8 cm), d_{last}, and d_{rem}. Follow the instructions in section 8.7.1.2 of this method for recording results for wall effects traverse points that are skipped. It should be noted that the full extent of velocity decay may not be accounted for if measurements are not taken at all 1-in. incremented points close to the wall.

8.2.3 Complete wall effects traverse. For a complete wall effects traverse, measurements must be taken at the following points in all four Method 1 equal-area sectors closest to the wall.

(a) The 1-in. incremented wall effects traverse point closest to the wall where the probe can be positioned and velocity can be detected, but no farther than 4 in. (10.2 cm) from the wall.

(b) Every subsequent 1-in. incremented wall effects traverse point out to the interior edge of the Method 1 equal-area sector or to 12 in. (30.5 cm) from the wall, whichever comes first. Note: In stacks or ducts with diameters greater than 15.6 ft (4.8 m) the interior edge of the Method 1 equal-area sector is farther from the wall than 12 in. (30.5 cm).

(c) d_{rem}, as determined using Equation 2H–1 or 2H–2 (as applicable). Note: For a complete traverse of a stack or duct with a diameter less than 16.5 ft (5.0 m), the distance between d_{rem} and d_{last} is less than or equal to ½ in. (12.7 mm). As discussed in section 8.2.4.2, when the distance between d_{rem} and d_{last} is less than or equal to ½ in. (12.7 mm), the velocity measured at d_{last} may be used for d_{rem}. Thus, it is not necessary to calculate the distance of d_{rem} or to take measurements at d_{rem} when conducting a complete traverse of a stack or duct with a diameter less than 16.5 ft (5.0 m).

8.2.4 Special considerations. The following special considerations apply when the distance between traverse points is less than or equal to ½ in. (12.7 mm).

8.2.4.1 A wall effects traverse point and the Method 1 traverse point. If the distance between a wall effects traverse point and the Method 1 traverse point is less than or equal to ½ in. (12.7 mm), taking measurements at both points is allowed but not required or recommended; if measurements are taken at only one point, take the measurements at the point that is farther from the wall and use the velocity obtained at that point as the value for both points (see sections 8.2.3 and 9.2 for related requirements).

8.2.4.2 d_{rem} and d_{last}. If the distance between d_{rem} and d_{last} is less than or equal to ½ in. (12.7 mm), taking measurements at d_{rem} is allowed but not required or recommended; if measurements are not taken at d_{rem}, the measured velocity value at d_{last} must be used as the value for both d_{last} and d_{rem}.

8.3 Traverse Point Sampling Order and Probe Selection. Determine the sampling order of the Method 1 and wall effects traverse points and select the appropriate probe for the measurements, taking into account the following considerations.

8.3.1 Traverse points on any radius may be sampled in either direction (i.e., from the wall toward the center of the stack or duct, or vice versa).

8.3.2 To reduce the likelihood of velocity variations during the time of the traverse and the attendant potential impact on the wall effects-adjusted and unadjusted average velocities, the following provisions of this method shall be met.

8.3.2.1 Each complete set of Method 1 and wall effects traverse points accessed from the same port shall be sampled without interruption. Unless traverses are performed simultaneously in all ports using separate probes at each port, this provision disallows first sampling all Method 1 points at all ports and then sampling all the wall effects points.

8.3.2.2 The entire integrated Method 1 and wall effects traverse across all test ports shall be as short as practicable, consistent with the measurement system response time (see section 8.4.1.1) and sampling (see section 8.4.1.2) provisions of this method.

8.3.3 It is recommended but not required that in each Method 1 equal-area sector closest to the wall, the Method 1 equal-area traverse point should be sampled in sequence between the adjacent wall effects traverse points. For example, for the traverse point configuration shown in Figure 2H–2, it is recommended that the Method 1 equal-area traverse point be sampled between d_{last} and d_{rem}. In this example, if the traverse is conducted from the wall toward the center of the stack or duct, it is recommended that measurements be taken at points in the following order: d_1, d_2, d_{last}, the Method 1 traverse point, d_{rem}, and then at the traverse points in the three Method 1 interior equal-area sectors.

8.3.4 The same type of probe must be used to take measurements at all Method 1 and wall effects traverse points. However, different copies of the same type of probe may be used at different ports (e.g., Type S probe 1 at port A, Type S probe 2 at port B) or at different traverse points accessed from a particular port (e.g., Type S probe 1 for Method 1 interior traverse points accessed from port A, Type S probe 2 for wall effects traverse points and the Method 1 exterior traverse point accessed from port A). The identification number of the probe used to obtain measurements at each traverse point must be recorded.

8.4 Measurements at Method 1 and Wall Effects Traverse Points. Conduct measurements at Method 1 and wall effects traverse points in accordance with Method 2, 2F, or 2G and in accordance with the provisions of the following subsections (some of which are included in Methods 2F and 2G but not in Method 2), which are particularly important for wall effects testing.

8.4.1 Probe residence time at wall effects traverse points. Due to the steep temperature and pressure gradients that can occur close to the wall, it is very important for the probe residence time (i.e., the total time spent at a traverse point) to be long enough to ensure collection of representative temperature and pressure measurements. The provisions of Methods 2F and 2G in the following subsections shall be observed.

8.4.1.1 System response time. Determine the response time of each probe measurement system by inserting and positioning the "cold" probe (at ambient temperature and pressure) at any Method 1 traverse point. Read and record the probe differential pressure, temperature, and elapsed time at 15-second intervals until stable readings for both pressure and temperature are achieved. The response time is the longer of these two elapsed times. Record the response time.

8.4.1.2 Sampling. At the start of testing in each port (i.e., after a probe has been inserted into the stack gas stream), allow at least the response time to elapse before beginning to take measurements at the first traverse point accessed from that port. Provided that the probe is not removed from the stack gas stream, measurements may be taken at subsequent traverse points accessed from the same test port without waiting again for the response time to elapse.

8.4.2 Temperature measurement for wall effects traverse points. Either (1) take temperature measurements at each wall effects traverse point in accordance with the applicable provisions of Method 2, 2F, or 2G; or (2) use the temperature measurement at the Method 1 traverse point closest to the wall as the temperature measurement for all the wall effects traverse points in the corresponding equal-area sector.

8.4.3 Non-detectable velocity pressure at wall effects traverse points. If the probe cannot be positioned at a wall effects traverse point or if no velocity pressure can be detected at a wall effects point, measurements shall be taken at the first subsequent wall effects traverse point farther from the wall where velocity can be detected. Follow the instructions in section 8.7.1.2 of this method for recording results for wall effects traverse points where velocity pressure cannot be detected. It should be noted that the full extent of velocity decay may not be accounted for if measurements are not taken at the 1-in. incremented wall effects traverse points closest to the wall.

8.5 Data Recording. For each wall effects and Method 1 traverse point where measurements are taken, record all pressure, temperature, and attendant measurements prescribed in section 3 of Method 2 or section 8.0 of Method 2F or 2G, as applicable.

8.6 Point Velocity Calculation. For each wall effects and Method 1 traverse point, calculate the point velocity value (v_i) in accordance with sections 12.1 and 12.2 of Method 2F for tests using Method 2F and in accordance with sections 12.1 and 12.2 of Method 2G for tests using Method 2 and Method 2G. (Note that the term (v_i) in this method corresponds to the term ($v_{a(i)}$) in Methods 2F and 2G.) When the equations in the indicated sections of Method 2G are used in deriving point velocity values for Method 2 tests, set the value of the yaw angles appearing in the equations to 0°.

8.7 Tabulating Calculated Point Velocity Values for Wall Effects Traverse Points. Enter the following values in a hardcopy or electronic form similar to Form 2H-1 (for 16-point Method 1 traverses) or Form 2H-2 (for Method 1 traverses consisting of more than 16 points). A separate form must be completed for each of the four Method 1 equal-area sectors that are closest to the wall.

(a) Port ID (e.g., A, B, C, or D)
(b) Probe type
(c) Probe ID
(d) Stack or duct diameter in ft (m) (determined in accordance with section 8.6 of Method 2F or Method 2G)
(e) Stack or duct radius in in. (cm)
(f) Distance from the wall of wall effects traverse points at 1-in. intervals, in ascending order starting with 1 in. (2.5 cm) (column A of Form 2H-1 or 2H-2)
(g) Point velocity values (v_d) for 1-in. incremented traverse points (see section 8.7.1), including d_{last} (see section 8.7.2)
(h) Point velocity value ($v_{d_{rem}}$) at d_{rem} (see section 8.7.3).

8.7.1 Point velocity values at wall effects traverse points other than d_{last}. For every 1-in. incremented wall effects traverse point other than d_{last}, enter in column B of Form 2H-1 or 2H-2 either the velocity measured at the point (see section 8.7.1.1) or the velocity measured at the first subsequent traverse point farther from the wall (see section 8.7.1.2). A velocity value must be entered in column B of Form 2H-1 or 2H-2 for every 1-in. incremented traverse point from d_1 (representing the wall effects traverse point 1 in. [2.5 cm] from the wall) to d_{last}.

8.7.1.1 For wall effects traverse points where the probe can be positioned and velocity pressure can be detected, enter the value obtained in accordance with section 8.6.

8.7.1.2 For wall effects traverse points that were skipped [see section 8.2.2.3(c)] and for points where the probe cannot be positioned or where no velocity pressure can be detected, enter the value obtained at the first subsequent traverse point farther from the wall where velocity pressure was detected and measured and follow the entered value with a "flag," such as the notation "NM," to indicate that "no measurements" were actually taken at this point.

8.7.2 Point velocity value at d_{last}. For d_{last}, enter in column B of Form 2H-1 or 2H-2 the measured value obtained in accordance with section 8.6.

8.7.3 Point velocity value ($v_{d_{rem}}$) at d_{rem}. Enter the point velocity value obtained at d_{rem} in column G of row 4a in Form 2H-1 or 2H-2. If the distance between d_{rem} and d_{last} is less than or equal to ½ in. (12.7 mm), the measured velocity value at d_{last} may be used as the value at d_{rem} (see section 8.2.4.2).

9.0 Quality Control.

9.1 Particulate Matter Build-up in Horizontal Ducts. Wall effects testing of horizontal circular ducts should be conducted only if build-up of particulate matter or other material in the bottom of the duct is not present.

9.2 Verifying Traverse Point Distances. In taking measurements at wall effects traverse points, it is very important for the probe impact pressure port to be positioned as close as practicable to the traverse point locations in the gas stream. For this reason, before beginning wall effects testing, it is important to calculate and record the traverse point positions that will be marked on each probe for each port, taking into account the distance that each port nipple (or probe mounting flange for automated probes) extends out of the stack and any extension of the port nipple (or mounting flange) into the gas stream. To ensure that traverse point positions are properly identified, the following procedures should be performed on each probe used.

9.2.1 Manual probes. Mark the probe insertion distance of the wall effects and Method 1 traverse points on the probe sheath so that when a mark is aligned with the outside face of the stack port, the probe impact port is located at the calculated distance of the traverse point from the stack inside wall. The use of different colored marks is recommended for designating the wall effects and Method 1 traverse points. Before the first use of each probe, check to ensure that the distance of each mark from the center of the probe impact pressure port agrees with the previously calculated traverse point positions to within ±¼ in. (6.4 mm).

9.2.2 Automated probe systems. For automated probe systems that mechanically position the probe head at prescribed traverse point positions, activate the system with the probe assemblies removed from the test ports and sequentially extend the probes to the programmed location of each wall effects traverse point and the Method 1 traverse points. Measure the distance between the center of the probe impact pressure port and the inside of the probe assembly mounting flange for each traverse point. The measured distances must agree with the previously calculated traverse point positions to within ±¼ in. (6.4 mm).

9.3 Probe Installation. Properly sealing the port area is particularly important in taking measurements at wall effects traverse points. For testing involving manual probes, the area between the probe sheath and the port should be sealed with a tightly fitting flexible seal made of an appropriate material such as heavy cloth so that leakage is minimized. For automated probe systems, the probe assembly mounting flange area should be checked to verify that there is no leakage.

9.4 Velocity Stability. This method should be performed only when the average gas velocity in the stack or duct is relatively constant over the duration of the test. If the average gas velocity changes significantly during the course of a wall effects test, the test results should be discarded.

10.0 Calibration

10.1 The calibration coefficient(s) or curves obtained under Method 2, 2F, or 2G and used to perform the Method 1 traverse are applicable under this method.

11.0 Analytical Procedure

11.1 Sample collection and analysis are concurrent for this method (see section 8).

12.0 Data Analysis and Calculations

12.1 The following calculations shall be performed to obtain a wall effects adjustment factor (*WAF*) from (1) the wall effects-unadjusted average velocity (v_{avg}), (2) the replacement velocity ($\hat{v}e_j$) for each of the four Method 1 sectors closest to the wall, and (3) the average stack gas velocity that accounts for velocity decay near the wall ($\hat{v}_{avg}$).

12.2 Nomenclature. The following terms are listed in the order in which they appear in Equations 2H–5 through 2H–21.

v_{avg}=the average stack gas velocity, unadjusted for wall effects, actual ft/sec (m/sec);

vi_i=stack gas point velocity value at Method 1 interior equal-area sectors, actual ft/sec (m/sec);

ve_j=stack gas point velocity value, unadjusted for wall effects, at Method 1 exterior equal-area sectors, actual ft/sec (m/sec);

i=index of Method 1 interior equal-area traverse points;

j=index of Method 1 exterior equal-area traverse points;

n=total number of traverse points in the Method 1 traverse;

$vdec_d$=the wall effects decay velocity for a sub-sector located between the traverse points at distances $d-1$ (in metric units, $d-2.5$) and *d* from the wall, actual ft/sec (m/sec);

v_d=the measured stack gas velocity at distance *d* from the wall, actual ft/sec (m/sec); Note: v_0=0;

d=the distance of a 1-in. incremented wall effects traverse point from the wall, for traverse points d_1 through d_{last}, in. (cm);

A_d=the cross-sectional area of a sub-sector located between the traverse points at distances $d-1$ (in metric units, $d-2.5$) and *d* from the wall, in.² (cm²) (e.g., sub-sector A_2 shown in Figures 2H–3 and 2H–4);

r=the stack or duct radius, in. (cm);

Q_d=the stack gas volumetric flow rate for a sub-sector located between the traverse points at distances $d-1$ (in metric units, $d-2.5$) and *d* from the wall, actual ft-in.²/sec (m-cm²/sec);

$V_{d.}$—\dλαστ=the total stack gas volumetric flow rate for all sub-sectors located between the wall and d_{last}, actual ft-in.²/sec (m-cm²/sec);

d_{last}=the distance from the wall of the last 1-in. incremented wall effects traverse point, in. (cm);

A_{drem}=the cross-sectional area of the sub-sector located between d_{last} and the interior edge of the Method 1 equal-area sector closest to the wall, in.² (cm²) (see Figure 2H–4);

p=the number of Method 1 traverse points per diameter, *p*≥8 (e.g., for a 16-point traverse, *p*=8);

d_{rem}=the distance from the wall of the centroid of the area between d_{last} and the interior edge of the Method 1 equal-area sector closest to the wall, in. (cm);

Q_{drem}=the total stack gas volumetric flow rate for the sub-sector located between d_{last} and the interior edge of the Method 1 equal-area sector closest to the wall, actual ft-in.²/sec (m-cm²/sec);

v_{drem}=the measured stack gas velocity at distance d_{rem} from the wall, actual ft/sec (m/sec);

Q_T=the total stack gas volumetric flow rate for the Method 1 equal-area sector closest to the wall, actual ft-in.²/sec (m-cm²/sec);

$\hat{v}_{ej}$=the replacement stack gas velocity for the Method 1 equal-area sector closest to the wall, i.e., the stack gas point velocity value, adjusted for wall effects, for the j[th] Method 1 equal-area sector closest to the wall, actual ft/sec (m/sec);

$\hat{v}_{avg}$=the average stack gas velocity that accounts for velocity decay near the wall, actual ft/sec (m/sec);

WAF=the wall effects adjustment factor derived from v_{avg} and $\hat{v}_{avg}$ for a single traverse, dimensionless;

$\hat{v}_{final}$=the final wall effects-adjusted average stack gas velocity that replaces the unadjusted average stack gas velocity obtained using Method 2, 2F, or 2G for a field test consisting of a single traverse, actual ft/sec (m/sec);

WAF=the wall effects adjustment factor that is applied to the average velocity, unadjusted for wall effects, in order to obtain the final wall effects-adjusted stack gas velocity, $\hat{v}_{final}$ or, $\hat{v}_{final(k)}$, dimensionless;

$\hat{v}_{final(k)}$=the final wall effects-adjusted average stack gas velocity that replaces the unadjusted average stack gas velocity obtained using Method 2, 2F, or 2G on run *k* of a RATA or other multiple-run field test procedure, actual ft/sec (m/sec);

$\hat{v}_{avg(k)}$=the average stack gas velocity, obtained on run *k* of a RATA or other multiple-run procedure, unadjusted for velocity decay near the wall, actual ft/sec (m/sec);

k=index of runs in a RATA or other multiple-run procedure.

12.3 Calculate the average stack gas velocity that does not account for velocity decay near the wall (v_{avg}) using Equation 2H–5.

$$v_{avg} = \frac{\left(\sum_{i=1}^{n-4} vi_i + \sum_{j=1}^{4} ve_j \right)}{n} \qquad \text{Eq. 2H-5}$$

(Note that v_{avg} in Equation 2H–5 is the same as $v_{(a)avg}$ in Equations 2F–9 and 2G–8 in Methods 2F and 2G, respectively.)

For a 16-point traverse, Equation 2H–5 may be written as follows:

$$v_{avg} = \frac{\left(\sum_{i=1}^{12} vi_i + \sum_{j=1}^{4} ve_j \right)}{16} \qquad \text{Eq. 2H-6}$$

12.4 Calculate the replacement velocity, $\hat{v}_{ej}$, for each of the four Method 1 equal-area sectors closest to the wall using the procedures described in sections 12.4.1 through 12.4.8. Forms 2H–1 and 2H–2 provide sample tables that may be used in either hardcopy or spreadsheet format to perform the calculations described in sections 12.4.1 through 12.4.8. Forms 2H–3 and 2H–4 provide examples of Form 2H–1 filled in for partial and complete wall effects traverses.

12.4.1 Calculate the average velocity (designated the "decay velocity," $vdec_d$) for each sub-sector located between the wall and d_{last} (see Figure 2H–3) using Equation 2H–7.

$$vdec_d = \frac{v_{d-1} + v_d}{2} \qquad \text{Eq. 2H-7}$$

For each line in column A of Form 2H–1 or 2H–2 that contains a value of d, enter the corresponding calculated value of $vdec_d$ in column C.

12.4.2 Calculate the cross-sectional area between the wall and the first 1-in. incremented wall effects traverse point and between successive 1-in. incremented wall effects traverse points, from the wall to d_{last} (see Figure 2H–3), using Equation 2H–8.

$$A_d = \frac{1}{4}\pi(r-d+1)^2 - \frac{1}{4}\pi(r-d)^2 \qquad \text{Eq. 2H-8}$$

For each line in column A of Form 2H–1 or 2H–2 that contains a value of d, enter the value of the expression $\frac{1}{4}\pi(r-d+1)^2$ in column D, the value of the expression $\frac{1}{4}\pi(r-d)^2$ in column E, and the value of A_d in column F. Note that Equation 2H–8 is designed for use only with English units (in.). If metric units (cm) are used, the first term, $\frac{1}{4}\pi(r-d+1)^2$, must be changed to $\frac{1}{4}\pi(r-d+2.5)^2$. This change must also be made in column D of Form 2H–1 or 2H–2.

12.4.3 Calculate the volumetric flow through each cross-sectional area derived in section 12.4.2 by multiplying the values of $vdec_d$, derived according to section 12.4.1, by the cross-sectional areas derived in section 12.4.2 using Equation 2H–9.

$$Q_d = vdec_d \times A_d \qquad \text{Eq. 2H-9}$$

For each line in column A of Form 2H–1 or 2H–2 that contains a value of *d, enter the corresponding calculated value of* Q_d in column G.

12.4.4 Calculate the total volumetric flow through all sub-sectors located between the wall and d_{last}, using Equation 2H–10.

$$Q_{d_1-d_{last}} = \sum_{d=1}^{d_{last}} Q_d \qquad \text{Eq. 2H-10}$$

Enter the calculated value of $Q_{d1 \rightarrow dlast}$ in line 3 of column G of Form 2H–1 or 2H–2.

12.4.5 Calculate the cross-sectional area of the sub-sector located between d_{last} and the interior edge of the Method 1 equal-area sector (e.g., sub-sector A_{drem} shown in Figures 2H–3 and 2H–4) using Equation 2H–11.

$$A_{drem} = \frac{1}{4}\pi(r - d_{last})^2 - \frac{p-2}{4p}\pi(r)^2 \qquad \text{Eq. 2H-11}$$

For a 16-point traverse (eight points per diameter), Equation 2H–11 may be written as follows:

$$A_{drem} = \frac{1}{4}\pi(r - d_{last})^2 - \frac{3}{16}\pi(r)^2 \qquad \text{Eq. 2H-12}$$

Enter the calculated value of A_{drem} in line 4b of column G of Form 2H–1 or 2H–2.

12.4.6 Calculate the volumetric flow for the sub-sector located between d_{last} and the interior edge of the Method 1 equal-area sector, using Equation 2H–13.

$$Q_{drem} = v_{drem} \times A_{drem} \qquad \text{Eq. 2H-13}$$

In Equation 2H–13, μ_{drem} is either (1) the measured velocity value at d_{rem} or (2) the measured velocity at d_{last}, if the distance between d_{drem} and d_{last} is less than or equal to ½ in. (12.7 mm) and no velocity measurement is taken at d_{rem} (see section 8.2.4.2). Enter the calculated value of Q_{drem} in line 4c of column G of Form 2H–1 or 2H–2.

12.4.7 Calculate the total volumetric flow for the Method 1 equal-area sector closest to the wall, using Equation 2H–14

$$Q_T = Q_{d_1 \rightarrow d_{last}} + Q_{drem} \qquad \text{Eq. 2H-14}$$

Enter the calculated value of Q_T in line 5a of column G of Form 2H–1 or 2H–2.

12.4.8 Calculate the wall effects-adjusted replacement velocity value for the Method 1 equal-area sector closest to the wall, using Equation 2H–15.

$$\hat{v}e_j = \frac{Q_T}{\frac{1}{2p}\pi(r)^2} \qquad \text{Eq. 2H-15}$$

For a 16-point traverse (eight points per diameter), Equation 2H–15 may be written as follows:

$$\hat{v}e_j = \frac{Q_T}{\frac{1}{16}\pi(r)^2} \qquad \text{Eq. 2H-16}$$

Enter the calculated value of $\hat{v}e_j$ in line 5b of column G of Form 2H–1 or 2H–2.

12.5 Calculate the wall effects-adjusted average velocity,, by replacing the four values of μ_{avg} shown in Equation 2H–5 with the four wall effects-adjusted replacement velocity values, μe, calculated according to section 12.4.8, using Equation 2H–17.

$$\hat{v}_{avg} = \frac{\left(\sum_{i=1}^{n-4} vi_i + \sum_{j=1}^{4} \hat{v}e_j\right)}{n} \qquad \text{Eq. 2H-17}$$

For a 16-point traverse, Equation 2H–17 may be written as follows:

$$\hat{v}_{avg} = \frac{\left(\sum_{i=1}^{12} vi_i + \sum_{j=1}^{4} \hat{v}e_j\right)}{16} \qquad \text{Eq. 2H-18}$$

12.6 Calculate the wall effects adjustment factor, WAF, using Equation 2H–19.

$$WAF = \frac{\hat{v}_{avg}}{v_{avg}} \qquad \text{Eq. 2H-19}$$

12.6.1 Partial wall effects traverse. If a partial wall effects traverse (see section 8.2.2) is conducted, the value obtained from Equation 2H–19 is acceptable and may be reported as the wall effects adjustment factor provided that the value is greater than or equal to 0.9800. If the value is less than 0.9800, it shall not be used and a wall effects adjustment factor of 0.9800 may be used instead.

12.6.2 Complete wall effects traverse. If a complete wall effects traverse (see section 8.2.3) is conducted, the value obtained from Equation 2H–19 is acceptable and may be reported as the wall effects adjustment factor provided that the value is greater than or equal to 0.9700. If the value is less than 0.9700, it shall not be used and a wall effects adjustment factor of 0.9700 may be used instead. If the wall effects adjustment factor for a particular stack or duct is less than 0.9700, the tester may (1) repeat the wall effects test, taking measurements at more Method 1 traverse points and (2) recalculate the wall effects adjustment factor from these measurements, in an attempt to obtain a wall effects adjustment factor that meets the 0.9700 specification and completely characterizes the wall effects.

12.7 Applying a Wall Effects Adjustment Factor. A default wall effects adjustment factor, as specified in section 8.1, or a calculated wall effects adjustment factor meeting the requirements of section 12.6.1 or 12.6.2 may be used to adjust the average stack gas velocity obtained using Methods 2, 2F, or 2G to take into account velocity decay near the wall of circular stacks or ducts. Default wall effects adjustment factors specified in section 8.1 and calculated wall effects adjustment factors that meet the requirements of section 12.6.1 and 12.6.2 are summarized in Table 2H–2.

12.7.1 Single-run tests. Calculate the final wall effects-adjusted average stack gas velocity for field tests consisting of a single traverse using Equation 2H–20.

$$\hat{v}_{final} = \overline{WAF} \times v_{avg} \qquad \text{Eq. 2H-20}$$

The wall effects adjustment factor, WAF, shown in Equation 2H–20, may be (1) a default wall effects adjustment factor, as specified in section 8.1, or (2) a calculated adjustment factor that meets the specifications in sections 12.6.1 or 12.6.2. If a calculated adjustment factor is used in Equation 2H–20, the factor must have been obtained during the same traverse in which μ_{avg} was obtained.

12.7.2 RATA or other multiple run test procedure. Calculate the final wall effects-adjusted average stack gas velocity for any run k of a RATA or other multiple-run procedure using Equation 2H–21.

$$\hat{v}_{final(k)} = \overline{WAF} \times v_{avg(k)} \qquad \text{Eq. 2H-21}$$

The wall effects adjustment factor, $\overline{WAF}$, shown in Equation 2H–21 may be (1) a default wall effects adjustment factor, as specified in section 8.1; (2) a calculated adjustment factor (meeting the specifications in sections 12.6.1 or 12.6.2) obtained from any single run of the RATA that includes run k; or (3) the arithmetic average of more than one WAF (each meeting the specifications in sections 12.6.1 or 12.6.2) obtained through wall effects testing conducted during several runs of the RATA that includes run k. If wall effects adjustment factors (meeting the specifications in sections 12.6.1 or 12.6.2) are determined for more than one RATA run, the arithmetic average of all of the resulting calculated wall effects adjustment factors must be used as the value of *WAF* and applied to all runs of that RATA. If a calculated, not a default, wall effects adjustment factor is used in Equation 2H–21, the average velocity unadjusted for wall effects, $\mu_{avg(k)}$, must be obtained from runs in which the number of Method 1 traverse points sampled does not exceed the number of Method 1 traverse points in the runs used to derive the wall effects adjustment factor, $\overline{WAF}$, shown in Equation 2H–21.

12.8 Calculating Volumetric Flow Using Final Wall Effects-Adjusted Average Velocity Value. To obtain a stack gas flow rate that accounts for velocity decay near the wall of circular stacks or ducts, replace μ_s in Equation 2–10 in Method 2, or $\mu_{a(avg)}$ a in Equations 2F–10 and 2F–11 in Method 2F, or $\mu_{a(avg)}$ in Equations 2G–9 and 2G–10 in Method 2G with one of the following.

12.8.1 For single-run test procedures, use the final wall effects-adjusted average stack gas velocity, μ_{final}, calculated according to Equation 2H–20.

12.8.2 For RATA and other multiple run test procedures, use the final wall effects-adjusted average stack gas velocity, $\mu_{final(k)}$ calculated according to Equation 2H–21.

13.0 Method Performance. [Reserved]

414.0 Pollution Prevention. [Reserved]

15.0 Waste Management. [Reserved]

16.0 Reporting

16.1 Field Test Reports. Field test reports shall be submitted to the Agency according to the applicable regulatory requirements. When Method 2H is performed in conjunction with Method 2, 2F, or 2G to derive a wall effects adjustment factor, a single consolidated Method 2H/2F (or 2H/2G) field test report should be prepared. At a minimum, the consolidated field test report should contain (1) all of the general information, and data for Method 1 points, specified in section 16.0 of Method 2F (when Method 2H is used in conjunction with Method 2F) or section 16.0 of Method 2G (when Method 2H is used in conjunction with Method 2 or 2G) and (2) the additional general information, and data for Method 1 points and wall effects points, specified in this section (some of which are included in section 16.0 of Methods 2F and 2G and are repeated in this section to ensure complete reporting for wall effects testing).

16.1.1 Description of the source and site. The field test report should include the descriptive information specified in section 16.1.1 of Method 2F (when using Method 2F) or 2G (when using either Method 2 or 2G). It should also include a description of the stack or duct's construction material along with the diagram showing the dimensions of the stack or duct at the test port elevation prescribed in Methods 2F and 2G. The diagram should indicate the location of all wall effects traverse points where measurements were taken as well as the Method 1 traverse points. The diagram should provide a unique identification number for each wall effects and Method 1 traverse point, its distance from the wall, and its location relative to the probe entry ports.

16.1.2 Field test forms. The field test report should include a copy of Form 2H–1, 2H–2, or an equivalent for each Method 1 exterior equal-area sector.

16.1.3 Field test data. The field test report should include the following data for the Method 1 and wall effects traverse.

16.1.3.1 Data for each traverse point. The field test report should include the values specified in section 16.1.3.2 of Method 2F (when using Method 2F) or 2G (when using either Method 2 or 2G) for each Method 1 and wall effects traverse point. The provisions of section 8.4.2 of Method 2H apply to the temperature measurements reported for wall effects traverse points. For each wall effects and Method 1 traverse point, the following values should also be included in the field test report.

(a) Traverse point identification number for each Method 1 and wall effects traverse point.

(b) Probe type.

(c) Probe identification number.

(d) Probe velocity calibration coefficient (i.e., C_p when Method 2 or 2G is used; F_2 when Method 2F is used).

For each Method 1 traverse point in an exterior equal-area sector, the following additional value should be included.

(e) Calculated replacement velocity, ve_j, accounting for wall effects.

16.1.3.2 Data for each run. The values specified in section 16.1.3.3 of Method 2F (when using Method 2F) or 2G (when using either Method 2 or 2G) should be included in the field test report once for each run. The provisions of section 12.8 of Method 2H apply for calculating the reported gas volumetric flow rate. In addition, the following Method 2H run values should also be included in the field test report.

(a) Average velocity for run, accounting for wall effects, $\bar{v}_{avg}$.

(b) Wall effects adjustment factor derived from a test run, WAF.

16.1.3.3 Data for a complete set of runs. The values specified in section 16.1.3.4 of Method 2F (when using Method 2F) or 2G (when using either Method 2 or 2G) should be included in the field test report once for each complete set of runs. In addition, the field test report should include the wall effects adjustment factor, $\overline{WAF}$, that is applied in accordance with section 12.7.1 or 12.7.2 to obtain the final wall effects-adjusted average stack gas velocity $\bar{v}_{final}$ or $\bar{v}_{final(k)}$.

16.1.4 Quality assurance and control. Quality assurance and control procedures, specifically tailored to wall effects testing, should be described.

16.2 Reporting a Default Wall Effects Adjustment Factor. When a default wall effects adjustment factor is used in accordance with section 8.1 of this method, its value and a description of the stack or duct's construction material should be reported in lieu of submitting a test report.

17.0 *References.*

(1) 40 CFR Part 60, Appendix A, Method 1'Sample and velocity traverses for stationary sources.

(2) 40 CFR Part 60, Appendix A, Method 2'Determination of stack gas velocity and volumetric flow rate (Type S pitot tube).

(3) 40 CFR Part 60, Appendix A, Method 2F'Determination of stack gas velocity and volumetric flow rate with three-dimensional probes.

(4) 40 CFR Part 60, Appendix A, Method 2G'Determination of stack gas velocity and volumetric flow rate with two-dimensional probes.

(5) 40 CFR Part 60, Appendix A, Method 3'Gas analysis for carbon dioxide, oxygen, excess air, and dry molecular weight.

(6) 40 CFR Part 60, Appendix A, Method 3A—Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources (instrumental analyzer procedure).

(7) 40 CFR Part 60, Appendix A, Method 4—Determination of moisture content in stack gases.

(8) Emission Measurement Center (EMC) Approved Alternative Method (ALT–011) "Alternative Method 2 Thermocouple Calibration Procedure."

(9) The Cadmus Group, Inc., 1998, "EPA Flow Reference Method Testing and Analysis: Data Report, Texas Utilities, DeCordova Steam Electric Station, Volume I: Test Description and Appendix A (Data Distribution Package)," EPA/430–R–98–015a.

(10) The Cadmus Group, Inc., 1998, "EPA Flow Reference Method Testing and Analysis: Data Report, Texas Utilities, Lake Hubbard Steam Electric Station, Volume I: Test Description and Appendix A (Data Distribution Package)," EPA/430–R–98–017a.

(11) The Cadmus Group, Inc., 1998, "EPA Flow Reference Method Testing and Analysis: Data Report, Pennsylvania Electric Co., G.P.U. Genco Homer City Station: Unit 1, Volume I: Test Description and Appendix A (Data Distribution Package)," EPA/430–R–98–018a.

(12) The Cadmus Group, Inc., May 1999, "EPA Flow Reference Method Testing and Analysis: Findings Report," EPA/430–R–99–009.

(13) The Cadmus Group, Inc., 1997, "EPA Flow Reference Method Testing and Analysis: Wind Tunnel Experimental Results," EPA/430–R–97–013.

(14) National Institute of Standards and Technology, 1998, "Report of Special Test of Air Speed Instrumentation, Four Prandtl Probes, Four S-Type Probes, Four French Probes, Four Modified Kiel Probes," Prepared for the U.S. Environmental Protection Agency under IAG No. DW13938432–01–0.

(15) National Institute of Standards and Technology, 1998, "Report of Special Test of Air Speed Instrumentation, Five Autoprobes," Prepared for the U.S. Environmental Protection Agency under IAG No. DW13938432–01–0.

(16) National Institute of Standards and Technology, 1998, "Report of Special Test of Air Speed Instrumentation, Eight Spherical Probes," Prepared for the U.S. Environmental Protection Agency under IAG No. DW13938432–01–0.

(17) National Institute of Standards and Technology, 1998, "Report of Special Test of Air Speed Instrumentation, Four DAT Probes," Prepared for the U.S. Environmental Protection Agency under IAG No. DW13938432–01–0.

(18) Massachusetts Institute of Technology (MIT), 1998, "Calibration of Eight Wind Speed Probes Over a Reynolds Number Range of 46,000 to 725,000 per Foot, Text and Summary Plots," Plus Appendices, WBWT–TR–1317, Prepared for The Cadmus Group, Inc., under EPA Contract 68–W6–0050, Work Assignment 0007AA–3.

(19) Fossil Energy Research Corporation, Final Report, "Velocity Probe Tests in Non-axial Flow Fields," November 1998. Prepared for the U.S. Environmental Protection Agency.

(20) Fossil Energy Research Corporation, "Additional Swirl Tunnel Tests: E-DAT and T-DAT Probes," February 24, 1999. Technical Memorandum Prepared for U.S. Environmental Protection Agency, P.O. No. 7W-1193-NALX.

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Table 2H-1. Distance from the Wall for the Interior Boundary, d_b, of a Method 1 Exterior Equal-Area Sector as a Function of the Stack or Duct Radius, r, and Number of Method 1 Traverse Points

Number of Method 1 Traverse Points	d_b
16	$0.134 \times r$
20	$0.106 \times r$
24	$0.087 \times r$
28	$0.074 \times r$
32	$0.065 \times r$
36	$0.057 \times r$
40	$0.051 \times r$
44	$0.047 \times r$
48	$0.043 \times r$

Table 2H-2 Default and Minimum Acceptable Calculated Wall Effects Adjustment Factors

		Brick and Mortar Stacks	All Other Stacks and Ducts
Default WAF		0.9900	0.9950
Minimum Acceptable WAF	Partial Traverse	0.9800	
	Complete Traverse	0.9700	

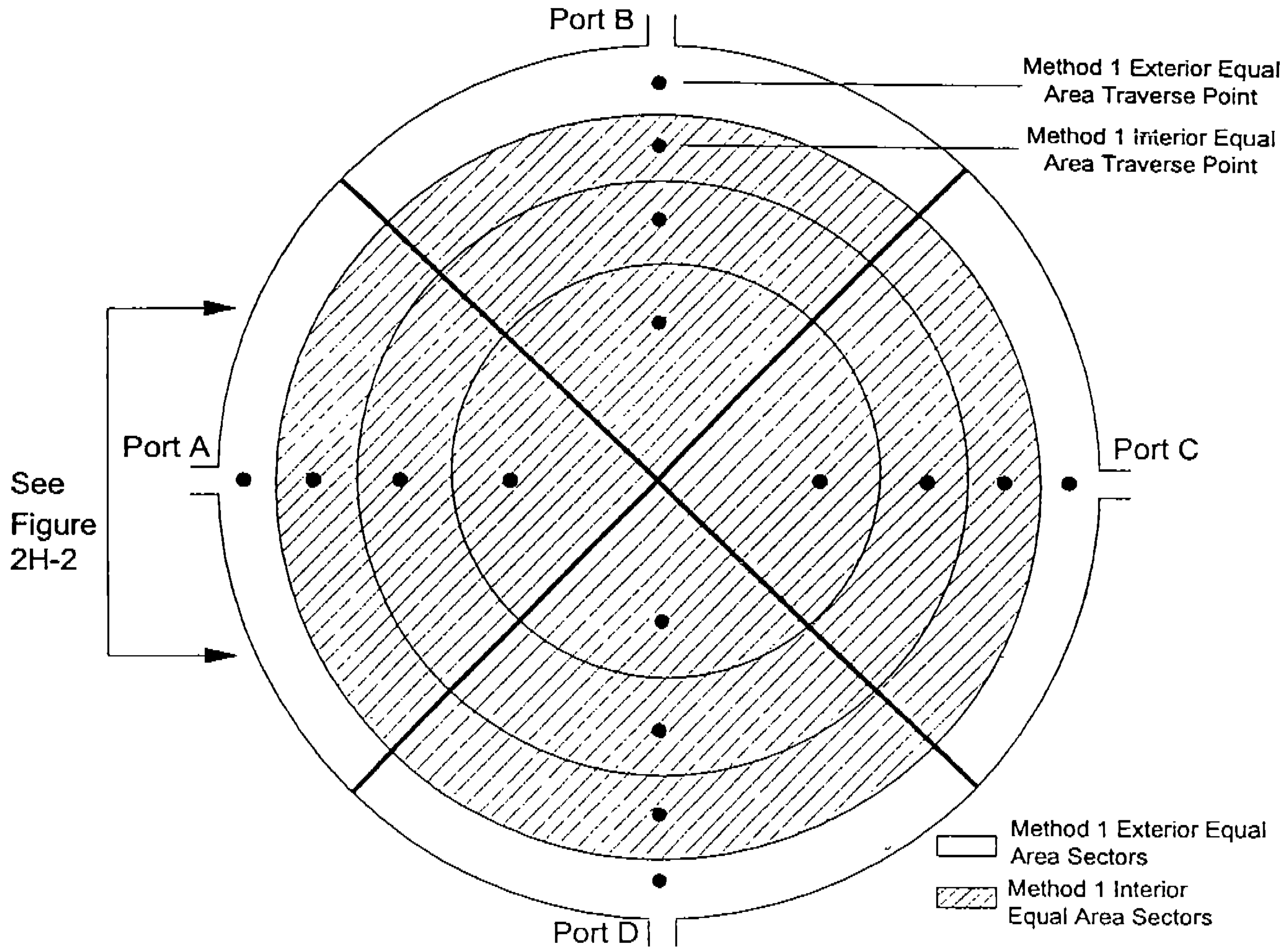

Figure 2H-1. Method 1 exterior and interior equal-area sectors with traverse points indicated.

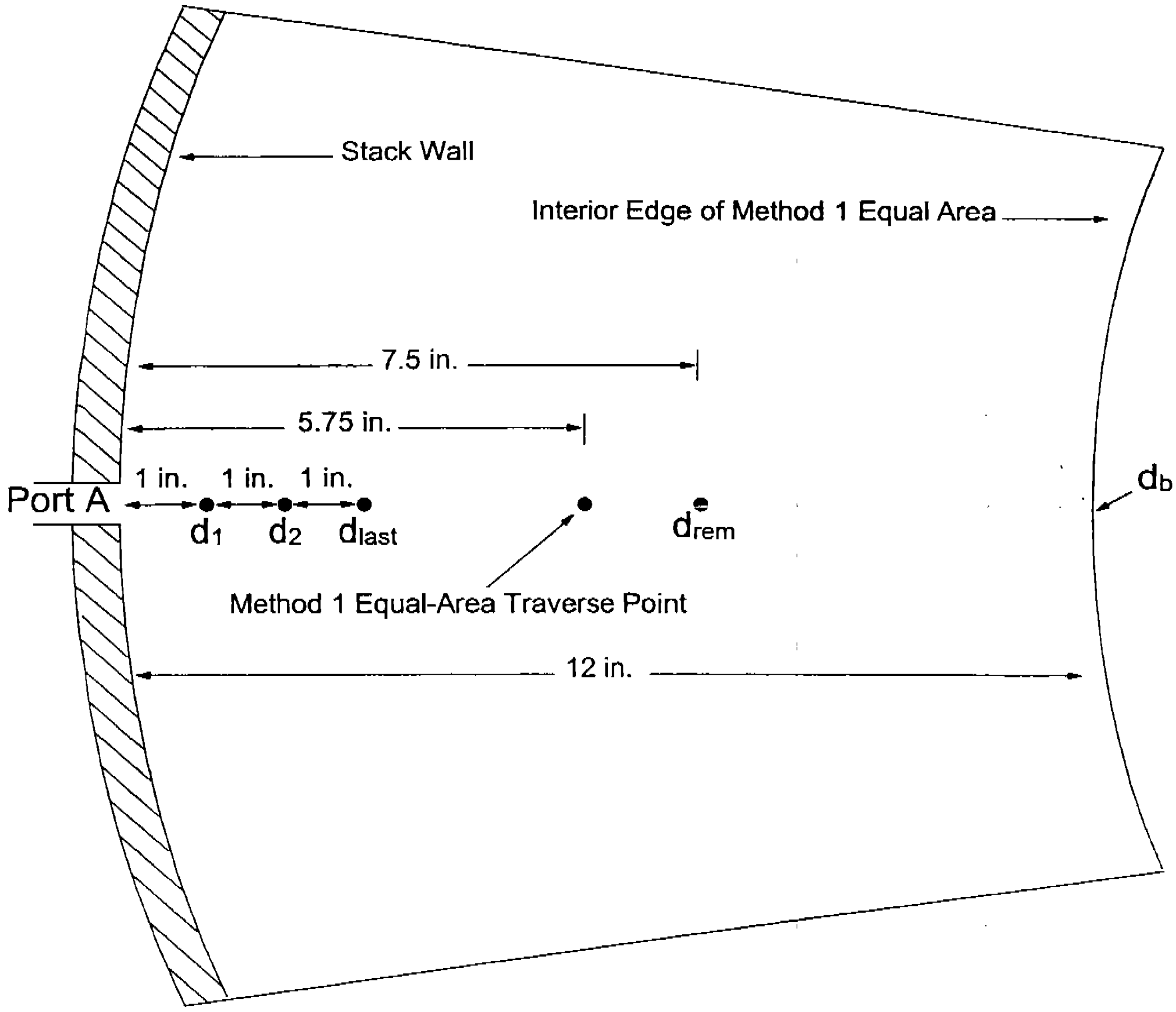

Figure 2H-2. Figure showing part of a Method 1 equal-area sector closest to the stack wall with three illustrative wall effects points at 1 in. intervals, the Method 1 equal-area traverse point, and d_{rem} for a 15 ft diameter stack.[1]

1 Metric equivalents of English units used in Figure 2H-2 are as follows: 1 in. = 2.5 cm; 5.75 in. = 14.6 cm; 7.5 in. = 19.0 cm; 12 in. = 30.5 cm; and 15 ft = 4.6 m.

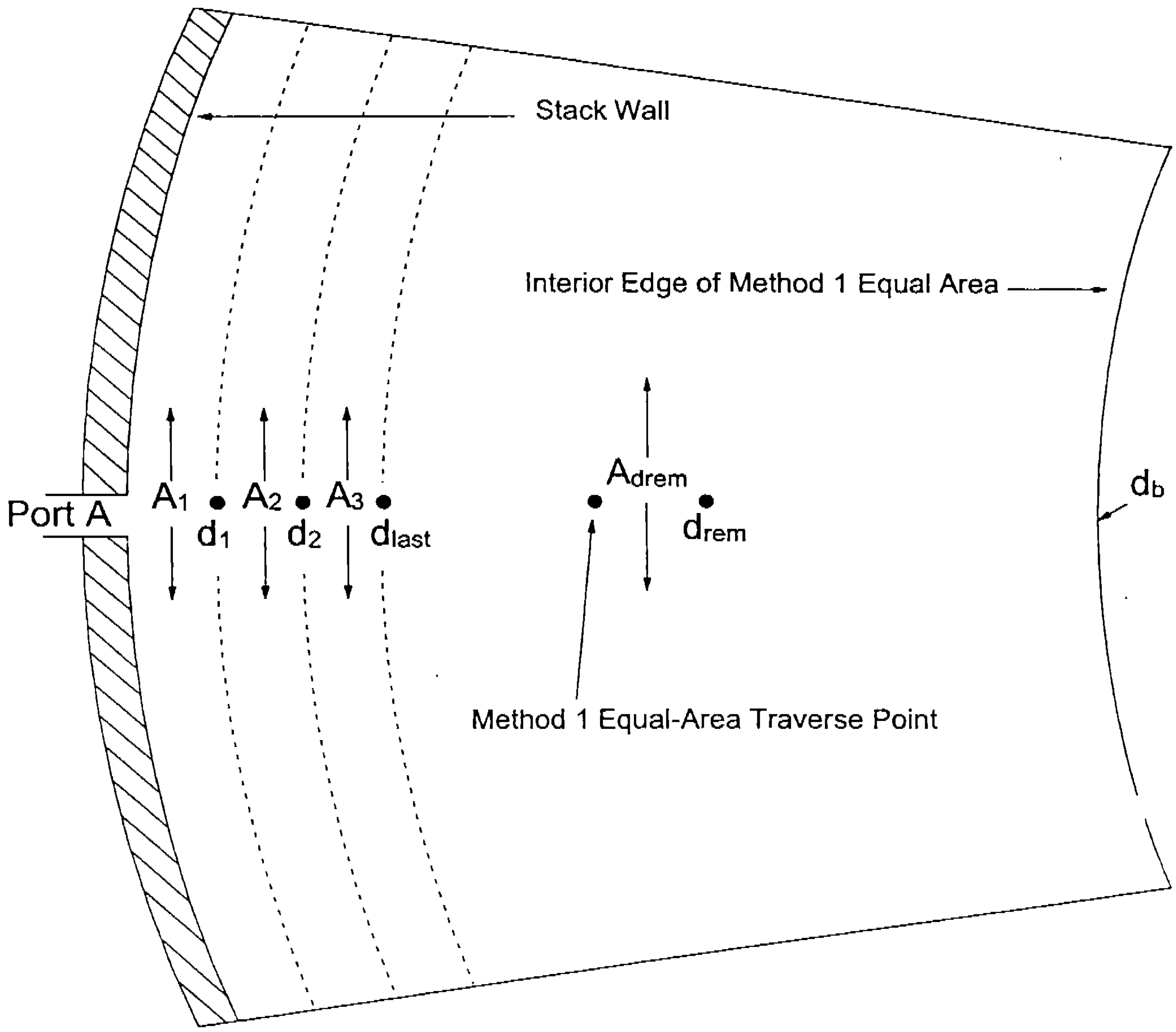

Figure 2H-3. Figure showing part of a Method 1 equal-area sector closest to the stack wall with three illustrative sub-sectors between the stack wall and d_{last} and the sub-sector represented by d_{rem}. A_1 is the area between the stack wall and d_1, A_2 is the area between d_1 and d_2, A_3 is the area between d_2 and d_{last}, and A_{drem} is the area between d_{last} and the interior edge of the Method 1 equal-area sector.

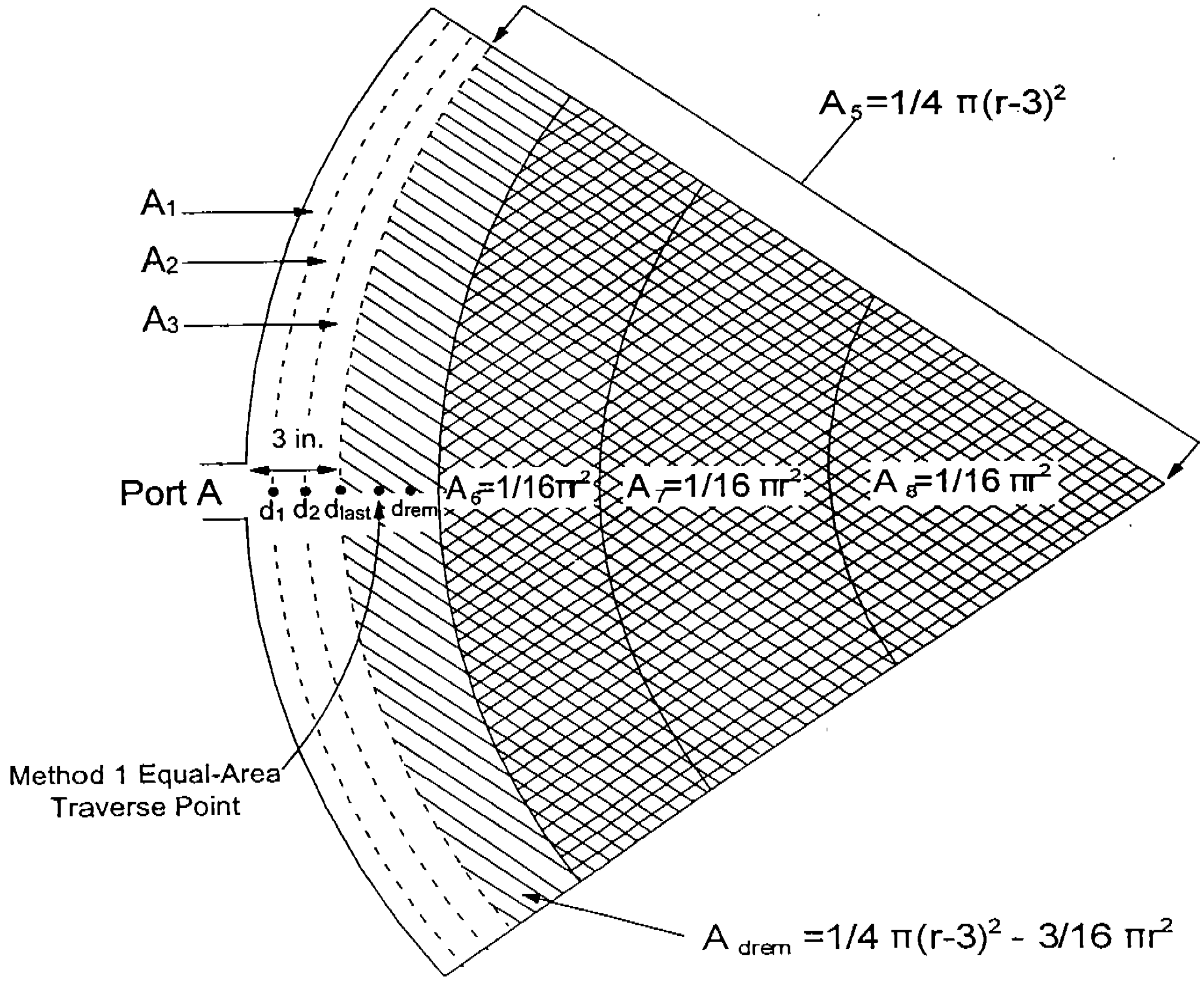

Figure 2H-4. Figure illustrating the calculations in Equation 2H-12 used to calculate the cross sectional area of the sub-sector between d_{last} and the interior edge of the Method 1 sector closest to the stack wall (A_{drem}) for a 16-point Method 1 traverse. The Method 1 equal-area traverse point and four wall effects traverse points (d_1, d_2, d_{last}, and d_{rem}) within the Method 1 sector closest to the stack wall are also shown.[1]

[1] All dimensions are given in in. Metric equivalents (in cm) are as follows: 3 in. = 7.6 cm; $A_5 = 1/4\ \pi(r-7.6)^2$; and $A_{drem} = 1/4\ \pi(r-7.6)^2 - 3/16\ \pi r^2$.

Form 2H-1. Calculation of Wall Effects Replacement Velocity Values (16-Point Method 1 Traverse)

1[st] Probe Type/ID/Pts. Sampled: ____________________ Tester(s): ____________________

2[nd] Probe Type/ID/Pts. Sampled: ____________________ Affiliation: ____________________

Entry Port ID (e.g., A, B, C, or D): __________

1. Diameter of the stack or duct (ft)		Radius, r, of the stack or duct (in.) (= diameter × 6)	

2. Location (column A), measured and decay velocities (columns B and C), and volumetric flow (column G) associated with each successive wall effects traverse point.

(A)	(B)	(C)	(D)	(E)	(F)	(G)
Distance (d) from Wall	Measured Velocity (v_d) at Distance d	Decay Velocity ($vdec_d$)	Intermediate Calculations		Area of Sub-sector (A_d)	Volumetric Flow in Sub-sector (Q_d)
		$\frac{v_{d-1}+v_d}{2}$ Note: $v_0 = 0$	$\frac{1}{4}\pi[r-d+1]^2$	$\frac{1}{4}\pi[r-d]^2$	(Col. D - Col. E)	(Col. C × Col. F)
(in.)	*(ft/sec)*	*(ft/sec)*	*(in.²)*	*(in.²)*	*(in.²)*	*(ft-in.²/sec)*
$d = 1$						
$d = 2$						
. . .						
d_{last}						

Note: $d_{last} \leq 0.1340\ r$, where r is the radius of the stack or duct. See section 8.2.2.3 of the method.

3. Total volumetric flow for all sub-sectors located between stack wall and d_{last} (total Col. G).	
4. Volumetric flow for remainder of the Method 1 equal-area sector.	
a. Velocity measurement at distance d_{rem} from stack wall (v_{drem}). (If d_{rem} - d_{last} <½ in., then no measurement at d_{rem} is necessary. Enter the velocity at d_{last} on this line.)	
b. Total area in remainder of Method 1 equal-area segment (A_{drem}). Subtract $\frac{3}{16}\pi(r)^2$ from last entry in item 2, column E, and enter the result on this line.	
c. Multiply values on lines 4a and 4b. (Q_{drem})	
5. Wall effects-adjusted velocity in the Method 1 equal-area sector.	
a. Add the values on lines 3 and 4c. (Q_T)	
b. Divide line 5a by $\frac{1}{16}\pi(r)^2$. The resulting value is one of four "replacement" point velocity values adjusted for wall effects, $\hat{v}e_{\perp}$, as derived in Equation 2H-16.	
6. Substitute the value shown in 5b for the unadjusted velocity value in the Method 1 sector. (See Eq. 2H-18.)	

Notes: 1. Column B: If no measurement is taken at distance d, enter the velocity value obtained at the first subsequent traverse point where a measurement was taken, followed by the letters "NM". See section 8.7.1.2.

2. For clarity, only English units are shown in this form. Following are metric equivalents of the English units used in the form. In row 2, column A: 1 in. = 2.5 cm; 2 in. = 5.1 cm. In row 2, column D: If metric units (cm) are used, the term ¼ $\pi(r-d+1)^2$ must be changed to ¼ $\pi(r-d+2.5)^2$. In row 4a: ½ in. = 12.7 mm. Throughout the form, the metric equivalents of *in.*, *in.²*, *ft*, *ft/sec*, and *ft-in²/sec* are *cm*, *cm²*, *m*, *m/sec*, and *m-cm²/sec*, respectively.

Form 2H-2. Calculation of Wall Effects Replacement Velocity Values (Any Method 1 Traverse ≥16 Points)

1st Probe Type/ID/Pts. Sampled: ______________ Tester(s): ______________

2nd Probe Type/ID/Pts. Sampled: ______________ Affiliation: ______________

Entry Port ID (e.g., A, B, C, or D): ______________

1. Diameter of the stack or duct (ft)		Radius, r, of the stack or duct (in.) (= diameter × 6)	

2. Location (Column A), measured and decay velocities (Columns B and C), and volumetric flow (Column G) associated with each successive wall effects traverse point.

(A)	(B)	(C)	(D)	(E)	(F)	(G)
Distance (d) from Wall	Measured Velocity (v_d) at Distance d	Decay Velocity ($vdec_d$)	Intermediate Calculations		Area of Sub-sector (A_d)	Volumetric Flow in Sub-sector (Q_d)
		$\frac{v_{d-1}+v_d}{2}$ Note: $v_0 = 0$	$\frac{2}{p}\pi[r-d+1]^2$	$\frac{2}{p}\pi[r-d]^2$	(Col. D - Col. E)	(Col. C × Col. F)
(in.)	*(ft/sec)*	*(ft/sec)*	*(in.²)*	*(in.²)*	*(in.²)*	*(ft-in.²/sec)*
$d = 1$						
$d = 2$						
. . .						
d_{last}						

Note: $d_{last} \leq d_b$, as defined in section 8.2.2.3 of the method.

3. Total volumetric flow for all sub-sectors located between stack wall and d_{last} (total Col. G).	
4. Volumetric flow for remainder of the Method 1 equal-area sector.	
a. Velocity measurement at distance d_{rem} from stack wall (v_{drem}). (If $d_{rem} - d_{last} < ½$ in., then no measurement at d_{rem} is necessary. Enter the velocity at d_{last} on this line.)	
b. Total area in remainder of Method 1 equal-area segment (A_{drem}). Subtract $\left(\frac{p-2}{4p}\right)\pi(r)^2$ from last entry in item 2, column E, and enter the result on this line.	
c. Multiply values on lines 4a and 4b. (Q_{drem})	
5. Wall effects-adjusted velocity in the Method 1 near-wall equal-area segment.	
a. Add the values on lines 3 and 4. (Q_T)	
b. Divide line 5a by $\left(\frac{1}{2p}\right)\pi(r)^2$. The resulting value is one of four "replacement" point velocity values adjusted for wall effects, $\hat{ve}_j$, as derived in Equation 2H-15.	
6. Substitute the value shown in 5b for the unadjusted velocity value in the Method 1 sector. (See Eq. 2H-17.)	

Notes: 1. Column B: If no measurement is taken at distance d, enter the velocity value obtained at the first subsequent traverse point where a measurement was taken, followed by the letters "NM". See section 8.7.1.2.

2. For clarity, only English units are shown in this form. Following are metric equivalents of the English units used in the form. In row 2, column A: 1 in. = 2.5 cm; 2 in. = 5.1 cm. In row 2, column D: If metric units (cm) are used, the term ¼ $\pi(r-d+1)^2$ must be changed to ¼ $\pi(r-d+2.5)^2$. In row 4a: ½ in. = 12.7 mm. Throughout the form, the metric equivalents of *in.*, *in.²*, *ft*, *ft/sec*, and *ft-in²/sec* are *cm*, *cm²*, *m*, *m/sec*, and *m-cm²/sec*, respectively.

Form 2H-3. Calculation of Replacement Velocity Values for a Method 1 Equal-Area Sector Closest to the Stack Wall for a 16-Point Method 1 Traverse, Using a Partial Wall Effects Traverse

1[st] Probe Type/ID/Pts. Sampled: *Type S Straight-up/S-13/All* Tester(s): *Test Team III*

2[nd] Probe Type/ID/Pts. Sampled: ______ Affiliation: *Contractor III*

Entry Port ID (e.g., A, B, C, or D): *A*

1. Diameter of the stack or duct (ft)	*24*
Radius, r, of the stack or duct (in.) (= diameter × 6)	*144*

2. Location (column A), measured and decay velocities (columns B and C), and volumetric flow (column G) associated with each successive wall effects traverse point.

(A)	(B)	(C)	(D)	(E)	(F)	(G)
Distance (d) from Wall	Measured Velocity (v_d) at Distance d	Decay Velocity ($vdec_d$)	Intermediate Calculations		Area of Sub-sector (A_d)	Volumetric Flow in Sub-sector (Q_d)
		$\frac{v_{d-1}+v_d}{2}$ Note: $v_0 = 0$	$\frac{1}{4}\pi[r-d+1]^2$	$\frac{1}{4}\pi[r-d]^2$	(Col. D - Col. E)	(Col. C × Col. F)
(in.)	*(ft/sec)*	*(ft/sec)*	*(in.²)*	*(in.²)*	*(in.²)*	*(ft-in.²/sec)*
d = 1	*51.71 NM*	*25.85*	*16,286.00*	*16,060.59*	*225.41*	*5,827.47*
d = 2	*51.71 NM*	*51.71*	*16,060.59*	*15,836.76*	*223.84*	*11,573.72*
d_{last} = 3	*51.71*	*51.71*	*15,836.76*	*15,614.49*	*222.27*	*11,492.51*

3. Total volumetric flow for all sub-sectors located between stack wall and d_{last} (total Col. G).	*28,893.70*
4. Volumetric flow for remainder of the Method 1 equal-area sector.	
a. Velocity measurement at distance d_{rem} from stack wall (v_{drem}). (If $d_{rem} - d_{last}$ <½ in., then no measurement at d_{rem} is necessary. Enter the velocity at d_{last} on this line.)	*77.01*
b. Total area in remainder of Method 1 equal-area segment (A_{drem}). Subtract $\frac{3}{16}\pi(r)^2$ from last entry in item 2, column E, and enter the result on this line.	*3,399.99*
c. Multiply values on lines 4a and 4b. (Q_{drem})	*261,832.90*
5. Wall effects-adjusted velocity in the Method 1 equal-area sector.	
a. Add the values on lines 3 and 4c. (Q_T)	*290,726.61*
b. Divide line 5a by $\frac{1}{16}\pi(r)^2$. The resulting value is one of four "replacement" point velocity values adjusted for wall effects, $\hat{v}e_j$, as derived in Equation 2H-16.	*71.41*
6. Substitute the value shown in 5b for the unadjusted velocity value in the Method 1 sector. (See Eq. 2H-18.)	

Form 2H-4 Calculation of Replacement Velocity Values for a Method 1 Equal-Area Sector Closest to the Stack Wall for a 16-Point Method 1 Traverse, Using a Complete Traverse

1st Probe Type/ID/Pts. Sampled: *Type S Straight-up/S-13/All* Tester(s): *Test Team III*

2nd Probe Type/ID/Pts. Sampled: ____ Affiliation: *Contractor III*

Entry Port ID (e.g., A, B, C, or D): *A*

1. Diameter of the stack or duct (ft)	*24*	Radius, r, of the stack or duct (in.) (= diameter × 6)				*144*
2. Location (column A), measured and decay velocities (columns B and C), and volumetric flow (column G) associated with each successive wall effects traverse point.						
(A)	(B)	(C)	(D)	(E)	(F)	(G)
Distance (d) from Wall	Measured Velocity (v_d) at Distance d	Decay Velocity ($vdec_d$)	Intermediate Calculations		Area of Sub-sector (A_d)	Volumetric Flow in Sub-sector (Q_d)
		$\frac{v_{d-1}+v_d}{2}$ Note: $v_0 = 0$	$\frac{1}{4}\pi[r-d+1]^2$	$\frac{1}{4}\pi[r-d]^2$	(Col. D - Col. E)	(Col. C × Col. F)
(in.)	*(ft/sec)*	*(ft/sec)*	*(in.²)*	*(in.²)*	*(in.²)*	*(ft-in.²/sec)*
$d = 1$	*51.71 NM*	*25.85*	*16,286.00*	*16,060.59*	*225.41*	*5,827.47*
$d = 2$	*51.71 NM*	*51.71*	*16,060.59*	*15,836.76*	*223.84*	*11,573.72*
$d = 3$	*51.71*	*51.71*	*15,836.76*	*15,614.49*	*222.27*	*11,492.51*
$d = 4$	*62.26*	*56.98*	*15,614.49*	*15,393.79*	*220.70*	*12,576.24*
$d = 5$	*67.16*	*64.71*	*15,393.79*	*15,174.67*	*219.13*	*14,179.40*
$d = 6$	*69.44*	*68.30*	*15,174.67*	*14,957.11*	*217.56*	*14,858.32*
$d = 7$	*72.63*	*71.03*	*14,957.11*	*14,741.13*	*215.98*	*15,341.75*
$d = 8$	*71.37*	*72.00*	*14,741.13*	*14,526.71*	*214.41*	*15,437.01*
$d = 9$	*74.37*	*72.87*	*14,526.71*	*14,313.87*	*212.84*	*15,510.03*
$d = 10$	*75.80*	*75.08*	*14,313.87*	*14,102.60*	*211.27*	*15,863.30*
$d = 11$	*77.15*	*76.47*	*14,102.60*	*13,892.90*	*209.70*	*16,035.93*
$d_{last} = 12$	*78.58*	*77.86*	*13,892.90*	*13,684.77*	*208.13*	*16,205.92*
3. Total volumetric flow for all sub-sectors located between stack wall and d_{last} (total Col. G).						*164,901.59*
4. Volumetric flow for remainder of the Method 1 equal-area sector.						
a. Velocity measurement at distance d_{rem} from stack wall (v_{drem}). (If $d_{rem} - d_{last} < ½$ in., then no measurement at d_{rem} is necessary. Enter the velocity at d_{last} on this line.)						*78.51*
b. Total area in remainder of Method 1 equal-area segment (A_{drem}). Subtract $\frac{3}{16}\pi(r)^2$ from last entry in item 2, column E, and enter the result on this line.						*1,470.26*
c. Multiply values on lines 4a and 4b. (Q_{drem})						*115,430.44*
5. Wall effects-adjusted velocity in the Method 1 equal-area sector.						
a. Add the values on lines 3 and 4c. (Q_T)						*280,332.03*
b. Divide line 5a by $\frac{1}{16}\pi(r)^2$. The resulting value is one of four "replacement" point velocity values adjusted for wall effects, $\hat{ve}_L$, as derived in Equation 2H-16.						*68.85*
6. Substitute the value shown in 5b for the unadjusted velocity value in the Method 1 sector. (See Eq. 2H-18.)						

* * * * *

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