

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 63

[IL-64-2-5807; FRL-5695-8]

RIN 2060-AE75

National Emission Standards for Hazardous Air Pollutants for Source Categories; Wool Fiberglass Manufacturing

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule and notice of public hearing.

SUMMARY: This action proposes national emission standards for hazardous air pollutants (NESHAP) for new and existing sources in wool fiberglass manufacturing facilities. The hazardous air pollutants (HAPs) emitted by the facilities covered by this proposed rule include three metals (arsenic, chromium, lead) and three organic HAPs (formaldehyde, phenol, and methanol). Exposure to these HAPs can cause reversible or irreversible health effects including carcinogenic, respiratory, nervous system, developmental, reproductive, and/or dermal health effects. The EPA estimates the proposed NESHAP would reduce nationwide emissions of HAPs from these facilities by 530 megagrams per year (Mg/yr) (580 tons per year [ton/yr]), an approximate 30 percent reduction from the current level of emissions. Emissions of particulate matter (PM) would be reduced by an estimated 760 Mg/yr (840 ton/yr) under the proposed NESHAP.

The standards are proposed under the authority of section 112(d) of the Clean Air Act (CAA) and are based on the Administrator's determination that wool fiberglass manufacturing facilities may reasonably be anticipated to emit several of the 188 HAPs listed in the draft 112(s) Report to Congress from the various process operations found within the industry. The proposed NESHAP would provide protection to the public by requiring all wool fiberglass plants that are major sources to meet emission standards reflecting the application of the maximum achievable control technology (MACT).

DATES: *Comments.* The EPA will accept comments on the proposed rule until May 30, 1997.

Public hearing. Anyone requesting a public hearing must contact the EPA no later than April 21, 1997. If a hearing is held, it will take place at 10 a.m. on April 30, 1997. Persons interested in attending the hearing should call the

contact person listed below to verify that a hearing will be held.

Request to speak at hearing. Persons wishing to present oral testimony must contact the person listed below (see ADDRESSES) by April 21, 1997.

ADDRESSES: Comments. Interested parties may submit written comments (in duplicate, if possible) to Docket No. A-95-24 at the following address: Air and Radiation Docket and Information Center (6102), U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460. The EPA requests that a separate copy of the comments also be sent to the contact person listed below.

Docket. Docket A-95-24, containing supporting information used in developing the proposed standard, is located at the above address in Room M-1500, Waterside Mall (ground floor), and may be inspected from 8:00 a.m. to 5:30 p.m., Monday through Friday. Copies of this information may be obtained by request from the Air Docket by calling (202) 260-7548. A reasonable fee may be charged for copying docket materials.

Public hearing. If anyone contacts the EPA requesting a public hearing by the required date (see DATES), the hearing will be held at the EPA Office of Administration Auditorium, Research Triangle Park, North Carolina 27711. Persons interested in presenting testimony should contact Ms. Cathy Coats at (919) 541-5422.

A verbatim transcript of the hearing and any written statements will be available for public inspection and copying during normal working hours at the EPA's Air and Radiation Docket in Washington, DC.

FOR FURTHER INFORMATION CONTACT: For information concerning the proposed regulation, contact Mr. William J. Neuffer, Minerals and Inorganic Chemicals Group, Emission Standards Division (MD-13) U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541-5435. For information regarding Methods 316 and 318, contact Ms. Rima N. Dishakjian, Emissions, Monitoring, and Analysis Division, telephone number (919) 541-0443.

SUPPLEMENTARY INFORMATION:

Regulated entities: Entities potentially regulated by this action are those industrial facilities that manufacture wool fiberglass. Regulated categories and entities are shown in Table 1. This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated

by final action on this proposal. This table lists the types of entities that EPA is now aware could potentially be regulated by final action on this proposal. To determine whether your facility is regulated by final action on this proposal, you should carefully examine the applicability criteria in section III.A of this preamble and in § 63.1380 of the proposed rule. If you have any questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

TABLE 1.—REGULATED CATEGORIES AND ENTITIES

Entity category	Description
Industrial	Wool Fiberglass Manufacturing Plants (SIC 3296).
Federal Government: Not Affected State/Local/Tribal Government: Not Affected	

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I. Statutory Authority

The statutory authority for this proposal 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).

II. Introduction

A. Background

Section 112(c) of the Act directs the Agency to list each category of major and area sources as appropriate emitting one or more of the 189 HAPs listed in section 112(b) of the Act. The EPA published an initial list of source categories on July 16, 1992 (57 FR 31576), and may amend the list at any time. "Wool Fiberglass Manufacturing" is one of the 174 categories of sources listed in the notice. As defined in the EPA report, Documentation for Developing the Initial Source Category List (docket item II-A-5), the Wool Fiberglass Manufacturing source category includes any facility engaged in producing wool fiberglass from sand, feldspar, sodium sulfate, anhydrous borax, boric acid, or any other materials. Facilities that manufacture mineral wool from rock, slag, and other similar materials are not included in the source category. On December 3, 1993 (58 FR 63941), EPA published a schedule for the promulgation of standards for the sources selected for regulation under section 112(c) of the Act. According to this schedule, MACT standards for this source category must be promulgated no later than November 15, 1997.

In the manufacture of wool fiberglass, molten glass is formed into fibers, which are bonded by an organic resin to produce a wool-like material used primarily for thermal and acoustical insulation. The EPA estimates that at the current level of control, 1,770 Mg/yr (1,950 ton/yr) of metal HAPs and formaldehyde are emitted from glass-melting furnaces and manufacturing lines in wool fiberglass plants nationwide. The HAPs released from glass-melting furnaces include arsenic, chromium, and lead; an estimated 750 Mg/yr (830 ton/yr) of particulate matter also are emitted. Organic HAPs (formaldehyde, phenol, and methanol) are released from rotary spin (RS) forming, curing, and cooling processes

and from flame attenuation (FA) forming and curing processes.

B. NESHAP for Source Categories

Section 112 of the Act requires that EPA promulgate regulations for the control of HAP emissions from both new and existing major sources. The statute requires the regulations to reflect the maximum degree of reduction in emissions of HAPs that is achievable taking into consideration the cost of achieving the emission reduction, any nonair quality health and environmental impacts, and energy requirements. This level of control is commonly referred to as MACT. For new sources, MACT standards cannot be less stringent than the emission control that is achieved in practice by the best-controlled similar source. [See section 112(d)(3).] The MACT standards for existing sources can be less stringent than standards for new sources, but they cannot be less stringent than the average emission limitation achieved by the best-performing 12 percent of existing sources for categories and subcategories with 30 or more sources, or the best-performing 5 sources for categories or subcategories with fewer than 30 sources. In essence, these MACT standards would ensure that all major sources of air toxic emissions achieve the level of control already being achieved by the better controlled and lower emitting sources in each category. This approach provides assurance to citizens that each major source of toxic air pollution will be required to effectively control its emissions. At the same time, this approach provides a level economic playing field, ensuring that facilities that employ cleaner processes and good emissions controls are not disadvantaged relative to competitors with poorer controls.

The control of HAPs is achieved through the promulgation of technology-based emission standards under sections 112(d) and 112(f) and work practice standards under 112(h) for categories of sources that emit HAPs. Emission reductions may be accomplished through the application of measures, processes, methods, systems, or techniques including, but not limited to: (1) Reducing the volume of, or eliminating emissions of, such pollutants through process changes, substitution of materials, or other modifications; (2) enclosing systems or processes to eliminate emissions; (3) collecting, capturing, or treating such pollutants when released from a process, stack, storage or fugitive emissions point; (4) design, equipment, work practice, or operational standards (including requirements for operator

training or certification) as provided in subsection (h); or (5) a combination of the above. [See section 112(d)(2).] The EPA may promulgate more stringent regulations to address residual risk that remains after the imposition of controls within 8 years of promulgation of the NESHAP. [See section 112(f)(2).]

C. Health Effects of Pollutants

The CAA was created, in part, "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population" [42 U.S.C. 7401(b)]. This proposed regulation would protect the public health by reducing emissions of HAPs from wool fiberglass manufacturing facilities. This proposed regulation is technology-based, i.e., based on MACT.

Emission data collected during development of this proposed NESHAP show that several HAPs are emitted from wool fiberglass manufacturing plants and will be reduced by implementation of the standard. The proposed emission limits would reduce emissions of three particulate metal HAPs: chromium, arsenic, and lead from glass melting furnaces. The organic HAPs (formaldehyde, phenol, and methanol) are emitted from wool fiberglass manufacturing lines and would also be reduced by the proposed standard. In addition to these HAPs and as a result of the control of the metal HAPs, the proposed standard also would reduce emissions of PM, which is regulated under the CAA as a criteria pollutant, and volatile organic compounds (VOC). More information on PM can be found in EPA's criteria document for PM emissions. Following is a summary of the potential health effects caused by exposure to these pollutants.

Three metals—arsenic, chromium, and lead—appear on the section 112(b) list of HAPs and are emitted from glass melting furnaces. Long-term inhalation exposure to arsenic is strongly associated with lung cancer, and also irritates the skin and mucous membranes. The EPA has classified arsenic as a Class A, known human carcinogen. The effects of inhaling chromium depend on whether the oxidation state of the metal is trivalent or hexavalent. Trivalent chromium is an essential nutrient, and is substantially less toxic than hexavalent chromium. Both types of chromium irritate the respiratory tract. Hexavalent chromium inhalation is associated with lung cancer, and EPA has classified it as a Class A, known human carcinogen. Data are insufficient to classify trivalent chromium as to human carcinogenicity.

Lead exposure damages the central nervous system, especially in children, who may suffer decreased IQ and other neurobehavioral deficits. Children and adults exposed to higher doses of lead may experience anemia, kidney damage, and high blood pressure. The EPA has classified lead as a Class B2, probable human carcinogen, on the basis of reports of kidney tumors in animal studies. (See docket items II-A-4, II-A-6, II-A-10, II-I-6, II-I-7, II-I-8.)

Exposure to formaldehyde, methanol, and phenol irritates the eyes, skin, and mucous membranes and causes conjunctivitis, dermal inflammation, and respiratory symptoms. Formaldehyde exposure has been associated with reproductive effects such as menstrual disorders and pregnancy problems in women workers. The EPA has classified formaldehyde as a Class B1, probable human carcinogen, on the basis of findings of nasal cancer in animal studies, and limited human data. Phenol has been shown to cause damage to the liver, kidney, cardiovascular system, and central nervous system in animal studies. Acute exposure to methanol (usually by ingestion) is well-known to cause blindness and severe metabolic acidosis, sometimes leading to death. Chronic methanol exposure, including inhalation, may cause central disturbances possibly leading to blindness. Data are not sufficient to classify either phenol or methanol as to potential human carcinogenicity. (See docket items II-A-7, II-A-9, II-I-2, II-I-3, II-I-4.)

Formaldehyde, phenol, and methanol also are VOCs, which are precursors to ozone formation. Ambient ozone can cause damage to lung tissue, reduction of lung function, and increased sensitivity of the lung to other irritants. Several provisions of the CAA are aimed at reducing emissions of VOC. Additional information on the health effects of ozone are included in EPA's Criteria document, which support the National Ambient Air Quality Standards (NAAQS) for ozone.

The EPA does recognize that the degree of adverse health effects can range from mild to severe. The extent and degree to which the health effects may be experienced is dependent upon (1) the ambient concentrations observed in the area (e.g., as influenced by emission rates, meteorological conditions, and terrain), (2) the frequency of and duration of exposures, (3) characteristics of exposed individuals (e.g., genetics, age, pre-existing health conditions, and lifestyles), and (4) pollutant-specific characteristics (e.g., toxicity, half-life in

the environment, bioaccumulation, and persistence).

D. Wool Fiberglass Manufacturing Industry Profile

Wool fiberglass products are primarily used as thermal and acoustical insulation for buildings, automobiles, aircraft, appliances, ductwork, and pipes. Other uses include liquid and air filtration. Approximately 90 percent of the wool fiberglass currently produced is for building insulation products.

Wool fiberglass is currently manufactured in the United States by five companies operating 27 plants in 15 states. According to the size definition applied to this industry by the U.S. Small Business Administration (750 company employees or less), none of these firms is classified as a small business. These plants operate a total of 74 manufacturing lines.

Wool fiberglass is manufactured in a process that forms thin fibers from molten glass. A typical wool fiberglass manufacturing line consists of the following processes: (1) Preparation of molten glass, (2) formation of fibers into a wool fiberglass mat, (3) curing the binder-coated fiberglass mat, (4) cooling the mat (not always present), and (5) backing, cutting, and packaging. Wool fiberglass manufacturing plants typically contain one or more manufacturing lines.

Raw materials for the glass batch are weighed, mixed, and conveyed to the glass melting furnace, which may be gas-fired, electric, or gas and electric combined. The primary component of wool fiberglass is sand, but it also includes varying quantities of feldspar, sodium sulfate, anhydrous borax, boric acid, and many other materials. Cullet, crushed recycled glass, is a primary component in most batches and is required by Executive Order for Federal agency purchases and by law in certain States. Two methods of forming fibers are used in the industry. In the rotary spin (RS) process, centrifugal force causes molten glass to flow through small holes in the wall of a rapidly rotating cylinder. In the flame attenuation (FA) process, molten glass flows by gravity from a small furnace, or pot, to form threads that are then attenuated (stretched to the point of breaking) with air and/or flame.

After the fibers are formed, they are sprayed with a binder and collected as a mat on a moving conveyor. The purpose of the binder is to hold the fibers together and its composition varies with product type. Typically, the binder consists of a solution of phenol-formaldehyde resin, water, urea, lignin, silane, and ammonia. The conveyor

carries the newly formed mat through an oven for curing of the thermosetting resin and then through a cooling section. Some products do not require curing and/or cooling. FA manufacturing lines do not have cooling processes.

No Federal air standards specifically apply to HAP emissions from wool fiberglass production plants. Emission limits for PM in the new source performance standards (NSPS) for glass manufacturing plants (40 CFR part 60, subpart CC) are applicable to gas-fired and modified process glass-melting furnaces in the wool fiberglass industry that were constructed, modified, or reconstructed after June 15, 1979. The NSPS for wool fiberglass insulation manufacturing plants (40 CFR part 60, subpart PPP) limits PM emissions from wool fiberglass insulation manufacturing lines using the RS forming process that were constructed, modified, or reconstructed after February 7, 1984. The NSPS does not require controls for VOC or organic HAPs.

As a result of the NSPS and State requirements, PM controls are in place for most glass-melting furnaces. Of the 56 gas and electric furnaces (including gas/electric combinations), 37 are equipped with baghouses or electrostatic precipitators (ESPs). Among those furnaces without add-on controls are 12 electric furnaces that control PM emissions through their design and operation.

Controls also are in place for RS manufacturing lines. All 40 RS forming processes control, to varying degrees, organic emissions using one or more of the several process modifications available to this industry. Of the 43 curing ovens, 14 are equipped with a thermal incinerator. Cooling process emissions are uncontrolled for organic HAP emissions.

Because of the differences in emissions potential, limitations on the application of process controls, and the dedication of lines to certain product categories, FA forming processes are separated into four subcategories: light density, automotive, heavy density, and pipe products. None of the light density or automotive FA forming processes are equipped with HAP controls. In a few instances, FA forming processes that produce heavy density products, are controlled using process modifications. All FA forming processes producing pipe products use process modifications. None of the 31 curing ovens on FA manufacturing lines are equipped with HAP emission controls.

E. Pollution Prevention

Pollution prevention is a partial basis for the emission standards for RS and FA manufacturing lines. The emission standard for RS manufacturing lines is formulated as the sum of the MACT floor emission levels for forming, curing, and cooling where process modification is the MACT floor for forming processes, incineration is the MACT floor for curing ovens, and no control is the MACT floor for cooling processes. The emission standards for new and existing FA manufacturing lines producing pipe products and new FA manufacturing lines producing heavy-density products are the sum of the MACT floor emission levels for forming and curing (there are no separate cooling processes on FA manufacturing lines). Process modification is the MACT floor for forming processes and no control is the MACT floor for curing ovens. By formulating the standard as a sum of the individual forming, curing, and cooling MACT floor emission levels for RS manufacturing lines and forming and curing MACT floor emission levels for certain FA manufacturing lines, we have allowed tradeoffs for existing facilities that will accomplish the same environmental results at lower costs and will encourage process modifications and pollution prevention alternatives. According to the industry, new RS manufacturing lines may be able to meet the line standard without the use of costly incinerators with their energy and other environmental impacts, such as increased nitrogen oxides (NO_x) and sulfur oxides (SO_x) emissions, by incorporating pollution prevention measures. Pollution prevention alternatives will also increase binder utilization efficiency and reduce production costs for industry. In selecting the format of the emission standard for emissions from

manufacturing lines, the EPA considered various alternatives such as setting separate emission limits for each process, i.e., forming, curing, and cooling. A line standard gives the industry greater flexibility in complying with the proposed emission limit and is the least costly because industry can avoid the capital and annual operating and maintenance costs associated with the purchase of add-on control equipment.

III. Summary of Proposed Standards*A. Applicability*

The proposed NESHAP applies to each of the following existing and newly constructed sources: glass-melting furnaces located at a wool fiberglass manufacturing plant (Standard Industrial Classification [SIC] code 3296), RS manufacturing lines that produce building insulation, and FA manufacturing lines producing pipe insulation. The proposed NESHAP also applies to new FA manufacturing lines producing heavy density products. Facilities that manufacture mineral wool from rock or slag are not subject to the proposed rule but are subject to a separate NESHAP for mineral wool production. Provisions are included in the NESHAP general provisions (40 CFR part 63, subpart A) for the owner or operator to obtain a determination of applicability. A facility that is determined to be an area source would not be subject to the NESHAP.

B. Emission Limits and Requirements

Emission limits for PM are proposed for glass-melting furnaces. Because the MACT floor for existing and the MACT floor for new glass-melting furnaces are the same, the same emission limit applies to both new and existing sources. Emission limits for formaldehyde also are proposed for each new or existing RS manufacturing line,

each new and existing FA manufacturing line producing pipe insulation, and each new FA manufacturing line producing heavy density products.

A surrogate approach, where PM serves as a surrogate for HAP metals and formaldehyde serves as a surrogate for organic HAPs, is employed to allow easier and less expensive testing and monitoring requirements. The proposed emission limits are in the same format (mass of emissions per unit of production) as the existing NSPS for glass-melting furnaces and for wool fiberglass plants—kilograms per megagram (kg/Mg) or pound per ton (lb/ton) of glass pulled. Application of the proposed emission limits to the manufacturing line (forming, curing, and cooling) is consistent with the existing NSPS and the use of a kg/Mg (lb/ton) format recognizes that common industry practice is to vent more than one process unit to common ductwork/controls. This format also provides greater flexibility in achieving compliance with the use of pollution prevention measures, especially process modifications that provide the same environmental benefits without the need to purchase add-on control devices. The proposed emission limits are presented in metric units in Table 2(a) and English units in Table 2(b).

The proposed emission limits for existing sources are based on the performance of the control technology identified as the MACT floor. The MACT floor for existing glass-melting furnaces is an ESP or a baghouse. Because well-designed and -operated ESPs and baghouses, which are the MACT floor for existing glass-melting furnaces, represent the best technologies available for controlling PM emissions, including HAP metals, the MACT floor for new sources is the same.

TABLE 2(a).—SUMMARY OF PROPOSED EMISSION LIMITS FOR NEW AND EXISTING GLASS-MELTING FURNACES AND RS AND FA MANUFACTURING LINES IN WOOL FIBERGLASS MANUFACTURING PLANTS
[Metric units]

Process	Emission limit	
	Existing	New
Furnace	0.25 kg of PM per Mg of glass pulled	0.25 kg of PM per Mg of glass pulled.
RS Manufacturing Line	0.6 kg of formaldehyde per Mg of glass pulled	0.40 kg of formaldehyde per Mg of glass pulled.
FA Manufacturing Line	Pipe Insulation	Pipe Insulation
	3.4 kg of formaldehyde per Mg of glass pulled	3.4 kg of formaldehyde per Mg of glass pulled.
	Heavy Density	Heavy Density
	None	3.9 kg of formaldehyde per Mg of glass pulled.

TABLE 2(b).—SUMMARY OF PROPOSED EMISSION LIMITS FOR NEW AND EXISTING GLASS-MELTING FURNACES AND RS AND FA MANUFACTURING LINES IN WOOL FIBERGLASS MANUFACTURING PLANTS
[English units]

Process	Emission limit	
	Existing	New
Furnace	0.50 lb of PM per ton of glass pulled	0.50 lb of PM per ton of glass pulled.
RS Manufacturing Line	1.2 lb of formaldehyde per ton of glass pulled	0.80 lb of formaldehyde per ton of glass pulled.
FA Manufacturing Line	Pipe Insulation	Pipe Insulation
	6.8 lb of formaldehyde per ton of glass pulled	6.8 lb of formaldehyde per ton of glass pulled.
	Heavy Density	Heavy Density
	None	7.8 lb of formaldehyde per ton of glass pulled.

The MACT floor for each new or existing RS manufacturing line is represented by the use of process modification(s) for the forming process and a thermal incinerator for each curing oven. The MACT floor for cooling processes on RS manufacturing lines is no control because none of the existing cooling processes are controlled for HAPs. According to the industry, some existing plants will have to upgrade their process modifications on forming in order to meet the proposed emission limit; none will have to install incinerators on curing to comply with the standard. Process modifications are also the basis for the proposed MACT floor for forming processes on each new and existing FA manufacturing line producing pipe insulation and each new FA manufacturing line producing heavy-density products. Because none of the curing processes on FA manufacturing lines are controlled, the MACT floor is no control.

C. Performance Test and Compliance Provisions

A one-time performance test would demonstrate initial compliance with the proposed emission limits. Under the proposed NESHAP, the owner or operator would measure PM emissions to the atmosphere from affected glass-melting furnaces using EPA Method 5 in 40 CFR part 60, appendix A and § 63.1389 (Test methods and procedures) of the proposed rule. EPA Method 316, "Sampling and Analysis for Formaldehyde from Stationary Sources in the Mineral Wool and Wool Fiberglass Industries," or Method 318, "Extractive FTIR Method for the Measurement of Emissions from the Mineral Wool and the Wool Fiberglass Industries" would be used to measure formaldehyde emissions. Methods 316 and 318 are being proposed concurrently with this proposed rule. Using information from the tests, the owner or operator would determine compliance with the applicable

emission limit using the instructions and equations in the proposed NESHAP. During the initial performance test, the owner or operator also would monitor and record the glass pull rate of the furnace during each of the three test runs and determine the emission rate for each run in kilograms (pounds) of emission per megagram (ton) of glass pulled (kg/Mg [lb/ton]). A determination of compliance would be based on the average of the three individual test runs.

If an ESP is used to control emissions from a glass-melting furnace, the proposed NESHAP requires the owner or operator to establish the ESP operating parameter(s) that will be used to monitor compliance. For example, the secondary voltage of each ESP electrical field may be monitored to determine proper ESP operations. During the initial performance test, the owner or operator would establish the parameters and the range of these parameter values to be used to monitor compliance with the PM emission limit.

If a glass-melting furnace is operated without the use of an add-on PM control device, the owner or operator must establish the furnace operating parameter(s) that will be used to monitor compliance. On cold top electric furnaces, for example, the temperature 18 to 24 inches above the glass melt may be used to indicate proper furnace operations. The owner or operator would establish the range of parameter values during the initial performance test to be used to monitor compliance with the PM emission limit.

To determine compliance with the proposed emission limits for new and existing RS manufacturing lines, the owner or operator would measure formaldehyde emissions to the atmosphere from forming, curing, and cooling processes and sum the emissions from these processes. For new and existing FA manufacturing lines producing pipe products and for new lines producing heavy-density products, the owner or operator would measure

emissions to the atmosphere from the forming and curing processes and sum the emissions. Using information from the tests, the owner or operator would convert the emission test results to the units of the standard using the instructions and equations in the proposed NESHAP.

The owner or operator would conduct the initial performance test for each new or existing RS manufacturing line while making building insulation product. Building insulation is defined in the proposed NESHAP as wool fiberglass insulation having a loss on ignition (LOI) of less than 8 percent and a density of less than 0.03 grams per cubic centimeter (g/cm³), or 2 pounds per cubic foot (lb/ft³). Initial performance tests for FA manufacturing lines would be conducted on new lines while manufacturing heavy-density products (LOI of 11 to 25 percent and a density of 0.01 to 0.05 g/cm³ [0.5 to 3 lb/ft³]) and on new and existing lines while manufacturing pipe products (LOI of 8 to 14 percent and a density of 0.05 to 0.1 g/cm³ [3 to 6 lb/ft³]).

During performance tests on RS manufacturing lines producing building insulation and certain FA manufacturing lines, the owner or operator would record the LOI of each product for each line tested, the free formaldehyde content of the resin(s) used during the tests, and the binder formulation(s) used during the tests. The performance tests would be conducted using the resin having the highest free formaldehyde content that the owner or operator expects to use on that line. After the performance test, if the owner or operator wants to use a resin with a higher free formaldehyde content or change the binder formulation, another emission test must be performed to demonstrate compliance. If the owner or operator uses forming process modifications to comply, the process parameters (such as binder solids, binder application rate, or LOI) and their associated levels that will

be used to monitor compliance must be established during the performance test. After the performance test, if the owner or operator wants to operate the forming process parameters outside the performance test levels, additional performance tests would be required to verify that the source is still in compliance. If a wet scrubbing control device is used to control formaldehyde emissions from an RS manufacturing line producing building insulation or from certain FA manufacturing lines, the owner or operator must establish the operating ranges of the pressure drop across each scrubber, the scrubbing liquid flow rate to each scrubber, and the identity and feed rate of any chemical additive. The owner or operator of a scrubber would also monitor and record the LOI, the free formaldehyde content of the resin used, and the formulation of the binder used during the performance test. If the owner or operator plans to operate the scrubber in such a way that the pressure drop, liquid flow rate, or chemical additive or chemical feed rate exceeds the values established during the performance tests, additional testing must be performed to demonstrate compliance.

The proposed rule would allow the owner or operator of RS manufacturing lines and FA manufacturing lines subject to the NESHAP to conduct short-term experimental production runs, where the formaldehyde content or other process parameter deviates from levels established during previous performance tests, without conducting additional performance tests. The owner or operator would have to apply for approval from the Administrator or delegated State agency to conduct such experimental production runs. The application would include information on the nature and duration of the test runs including plans to perform emission testing. Such experimental production runs are important to industry and allow them to develop new products, improve existing products, and determine the effects on product quality and on emissions of process modifications being considered, such as binder reformulation.

If a thermal incinerator is used to comply with the proposed emission limit for formaldehyde, the owner or operator would measure the incinerator operating temperature that will be used to monitor compliance. During the initial performance test, the owner or operator would continuously record the incinerator's operating temperature and determine the average temperature during each 1-hour test run. The average

of the three test runs would be used to monitor incinerator compliance.

D. Monitoring Requirements

All owners or operators subject to the proposed NESHAP would submit an operations, maintenance, and monitoring plan as part of their application for a part 70 permit. The plan would include procedures for the proper operation and maintenance of processes and control devices used to comply with the proposed emission limits as well as the corrective actions to be taken when control device or process parameters deviate from allowable levels established during performance testing. The plan would also identify the control device parameters or process parameters to be monitored for compliance, a monitoring schedule, and procedures for keeping records to document compliance.

Under the proposed NESHAP, each baghouse used on a glass-melting furnace would have installed a bag leak detection system that is equipped with an audible alarm that automatically sounds when an increase in particulate emissions above a predetermined level is detected. The monitor must be capable of detecting PM emissions at concentrations of 1.0 milligram per actual cubic meter (0.0004 grains per actual cubic foot) and provide an output of relative or absolute PM emissions. Such a device would serve as an indicator of the performance of the baghouse and would provide an indication of when maintenance of the baghouse is needed. An alarm by itself does not indicate noncompliance with the PM emission limit. An alarm would indicate an increase in PM emissions and trigger an inspection of the baghouse to determine the cause of the alarm. The owner or operator would initiate corrective actions according to the procedures in their operations, maintenance, and monitoring plan. The source would be considered out of compliance upon failure to initiate corrective actions within 1 hour of the alarm. If the alarm is activated for more than 5 percent of the total operating time during the 6-month reporting period, the owner or operator must implement a Quality Improvement Plan (QIP) consistent with subpart D of the draft approach to compliance assurance monitoring.¹

For each ESP controlling PM emissions from a glass-melting furnace, the owner or operator would submit as part of their operations, maintenance, and monitoring plan, a description of

how the ESP is to be operated and maintained, the ESP parameter(s) to be monitored, a monitoring schedule, and recordkeeping requirements that document compliance. Corrective action would be taken if the range of acceptable values for the selected ESP operating parameter(s), such as secondary voltage, established during the initial performance test is exceeded based on any 3-hour average of the monitored parameter. A deviation outside the established range would trigger an inspection of the control device to determine the cause of the deviation and to initiate corrective actions according to the procedures in the facility's operations, maintenance, and monitoring plan. Failure to initiate corrective actions within 1 hour of the deviation would be considered noncompliance. If the ESP parameter values are outside the range established during the performance test for more than 5 percent of total operating time in a 6-month reporting period, the owner or operator would implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.² If the ESP parameter values are outside the range for more than 10 percent of total operating time in a 6-month reporting period, the owner or operator would be in violation of the standard.

Under the proposed NESHAP, the owner or operator of a glass-melting furnace whose emissions are not exhausted to an air pollution control device for PM control, would submit as part of their operations, maintenance, and monitoring plan a description of how the furnace is to be operated and maintained, the furnace parameter(s) to be monitored for compliance purposes, a monitoring schedule, and recordkeeping requirements that document compliance. Corrective action would be taken if the range of acceptable values for the selected operating parameter(s), such as air temperature above the glass melt in a cold top electric furnace, established during the initial performance test is exceeded based on any 3-hour average of the monitored parameter. A deviation outside the established range would trigger an inspection of the glass-melting furnace to determine the cause of the deviation and to initiate corrective actions according to the procedures in the facility's operations, maintenance, and monitoring plan. Failure to initiate corrective actions within 1 hour of the deviation would be considered noncompliance. If the furnace operating

¹ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

² Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

parameter values are outside the range established during the performance test for more than 5 percent of total operating time in a 6-month reporting period, the owner or operator would implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.³ If the furnace parameter values are outside the range for more than 10 percent of total operating time in a 6-month reporting period, the owner or operator would be in violation of the standard.

Under the proposed NESHAP, the owner or operator would continuously monitor and record the glass pull rate on all existing and new glass-melting furnaces. The exception to this would be existing furnaces that do not have continuous monitoring equipment. Such furnaces would measure the glass pull rate at least once per day. If the pull rate exceeds by more than 20 percent the average glass pull rate measured during the performance test, the owner or operator must initiate corrective actions within 1 hour. If the glass pull rate exceeds (by more than 20 percent) the average established during the performance test for more than 5 percent of the total operating time in a 6-month reporting period, a QIP must be implemented consistent with subpart D of the draft approach to compliance assurance monitoring.⁴ If the glass pull rate exceeds (by more than 20 percent) the average established during the performance test for more than 10 percent of the total operating time in a 6-month reporting period, it is a violation of the standard. Under the proposed NESHAP, the owner or operator would be allowed to do additional performance testing to verify compliance while operating at glass pull rates that exceed the level established during the initial performance test. The additional performance testing would be required to demonstrate compliance with the applicable formaldehyde emission limits for the affected manufacturing line only.

RS manufacturing lines that produce building insulation and certain FA manufacturing lines would monitor and record the free formaldehyde content of each resin lot, the binder formulation of each batch, and product LOI at least once each day. If resin-free formaldehyde content exceeds the performance test levels, the owner or operator would be in violation of the standard. Under the proposed NESHAP, the binder formulation must not deviate

from the formulation specifications used during the performance test.

An owner or operator of affected RS or FA manufacturing lines that use process modifications to comply with the emission standard would include in their written operations, maintenance, and monitoring plan how the process will be operated and maintained and identify the process parameters to be monitored, a monitoring schedule, and recordkeeping requirements that document compliance. Examples of process parameters that might be used to monitor compliance include product LOI, binder solids, and binder application rate. The plan would also have to demonstrate that the parameter(s) to be monitored correlate with formaldehyde emissions. The plan would include procedures for establishing maximum or minimum values, as appropriate, based on initial performance testing. Should the process parameter(s) deviate from the range established during the performance test, the owner or operator must inspect the process to determine the cause of the deviation and initiate corrective action within 1 hour of the deviation. If the process parameter(s) is outside the performance test range for more than 5 percent of total operating time during a 6-month reporting period, the owner or operator would implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.⁵ If the process parameter(s) is outside the range for more than 10 percent of total operating time in a 6-month reporting period, the owner or operator would be in violation of the standard.

An owner or operator who uses a wet scrubbing control device to control formaldehyde emissions from an RS manufacturing line producing building insulation or from certain FA manufacturing lines would continuously monitor and record the pressure drop across each scrubber, the scrubbing liquid flow rate to each scrubber, and the identity and feed rate of any chemical added to the scrubbing liquid. Under the proposed monitoring provisions, corrective action would be taken if any 3-hour average scrubber parameter is outside the range of acceptable values established during the initial performance test. If there was a deviation outside the established range, the owner or operator would inspect the process to determine the cause of the deviation and to initiate corrective actions according to the procedures in the facility's operations, maintenance,

and monitoring plan. The owner or operator of the scrubber would be out of compliance upon failure to initiate corrective actions within 1 hour of the deviation. If any scrubber parameter is outside the performance test range for more than 5 percent of the total operating time in a 6-month reporting period, the owner or operator would implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.⁶ If any scrubber parameter is outside the range for more than 10 percent of total operating time in a 6-month reporting period, the owner or operator would be in violation of the standard.

If an incinerator is used to control formaldehyde emissions from a manufacturing line or from individual forming or curing processes, the owner or operator would continuously monitor and record the operating temperature of each incinerator. The temperature monitoring device would be installed in the incinerator firebox. This is typically done using a thermocouple (a standard feature on most incinerators) and a strip chart recorder or data logger. Following the initial performance test, the owner or operator must maintain the temperature so that the temperature, averaged over a 3-hour period, does not fall below the average temperature established during the initial performance test. A temperature below the performance test average would be considered a violation of the standard.

The owner or operator may modify any of the control device or process parameter levels established during the initial performance tests for compliance monitoring. The proposed NESHAP contains provisions that would allow the owner or operator to change add-on control device and process parameter values from those established during the initial performance tests by performing additional emission testing to verify compliance.

As required by the NESHAP general provisions (40 CFR part 63, subpart A), the owner or operator must develop and implement a separate startup, shutdown, and malfunction plan. The plan would include procedures for the inspection and determination of the cause of a process or control device malfunction and the corrective procedures to be followed to remedy the malfunction.

E. Notification, Recordkeeping, and Reporting Requirements

All notification, recordkeeping, and reporting requirements in the general

³ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

⁴ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

⁵ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

⁶ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

provisions would apply to wool fiberglass manufacturing facilities. These include: (1) initial notification(s) of applicability, notification of performance test, and notification of compliance status; (2) a report of performance test results; (3) a startup, shutdown, and malfunction plan with semiannual reports of any reportable events; and (4) semiannual reports of deviations from established parameters. If deviations from established parameters are reported, the owner or operator must report quarterly until a request to return the reporting frequency to semiannual is approved. In addition to the requirements of the general provisions, the owner or operator would maintain records of the following, as applicable:

(1) Bag leak detection system alarms, including the date and time, with a brief explanation of the cause of the alarm and the corrective action taken;

(2) ESP monitoring plan parameter values, such as the secondary voltage of each electrical field, for each ESP used to control PM emissions from a glass-melting furnace, including any period when the parameter values deviate from those established during the performance test, with a brief explanation of the cause of the deviation and the corrective action taken;

(3) Uncontrolled glass-melting furnace operating parameter values, such as the temperature readings taken above the molten glass in cold top electric furnaces, including any period when the operating parameter values deviate from those established during the performance test, with a brief explanation of the cause of the deviation and the corrective action taken;

(4) The LOI and product density for each bonded product manufactured on an RS or FA manufacturing line subject to this NESHAP;

(5) The free formaldehyde content of each resin lot and the binder formulation of each batch used in the production of bonded wool fiberglass on RS or FA manufacturing lines subject to this NESHAP;

(6) Process parameters for RS and FA manufacturing lines that comply with the emission standards using process modifications, including any period when the parameter levels deviate from levels established during the performance test and the corrective actions taken;

(7) Scrubber pressure drop, scrubbing liquid flow rate, and any chemical additive (including chemical feed rate to the scrubber), including any period when the parameter levels deviate from those established during the

performance tests and the corrective action taken.

(8) Incinerator operating temperature, including any period when the temperature falls below the average level established during the performance test, with a brief explanation of the cause of the deviation and the corrective action taken;

(9) Glass pull rate including any period when the pull rate exceeded the average pull rate established during the performance test by more than 20 percent with a brief explanation of the cause of the exceedance and the corrective action taken.

Initial performance tests and compliance assurance monitoring requirements for forming process modifications apply only when building insulation products are being manufactured on RS manufacturing lines and when pipe products are being manufactured on new and existing FA manufacturing lines and heavy-density products are being manufactured on new FA manufacturing lines. The LOI must be monitored to demonstrate to EPA the products being manufactured and which lines are subject to the standard. During periods when other products are being manufactured, it is expected that the parameter values, such as LOI or binder solids, may vary from those levels established during the initial performance tests for building insulation on RS manufacturing lines and heavy-density or pipe products on FA manufacturing lines. The NESHAP general provisions (40 CFR part 63, subpart A) require that records be maintained for at least 5 years from the date of each record. The owner or operator must retain the records onsite for at least 2 years but may retain the records offsite the remaining 3 years. The files may be retained on microfilm, on microfiche, on a computer, on computer disks, or on magnetic tape disks. Reports may be made on paper or on a labeled computer disk using commonly available and compatible computer software.

IV. Impacts of Proposed Standards

A. Applicability

All plants in the industry would be subject to the proposed NESHAP unless the owner or operator demonstrates the facility is not a major source according to the requirements in the NESHAP general provisions. Seven of the 30 electric or gas/electric combination glass-melting furnaces are not controlled and are expected to need to install a baghouse or ESP to comply with the proposed emission limit. All gas-fired glass-melting furnaces are well

controlled and are expected to be in compliance with the NESHAP. Certain uncontrolled glass-melting furnaces, such as cold top electric furnaces, maintain low PM emissions as a result of their design and operation and are expected to meet the emission limits without the addition of control devices. Some RS forming processes would need to upgrade their process modifications to meet the emission limits for manufacturing lines.

B. Air Quality Impacts (Docket Item II-B-22)

Most of the existing glass-melting furnaces are already well controlled. At the current high level of control, nationwide emissions of PM are about 750 Mg/yr (830 ton/yr). Because of the existence of controls on all gas furnaces and the emission limiting design and operation of cold top electric furnaces, no emission reduction is expected from gas or cold top electric furnaces under the proposed NESHAP. There are 30 electric or combination gas/electric furnaces of which 23 are well controlled. Under the proposed NESHAP, it is expected that baghouses would be added to the seven uncontrolled electric glass-melting furnaces, which would result in a reduction in nationwide PM emissions of 600 Mg/yr (660 ton/yr) of which 40 Mg/yr (50 ton/yr) is particulate matter less than 10 microns (μm) in diameter (PM-10) (docket item II-B-20). Impacts on new furnaces will vary. New gas-fired glass-melting furnaces would be adequately controlled, even in the absence of the proposed NESHAP, as a result of the NSPS for glass manufacturing plants (40 CFR part 60, subpart CC). Because of their design and operation, new cold top electric furnaces would meet the proposed emission limit for new furnaces without add-on controls. Only new electric furnaces are expected to be impacted by the proposed emission limits for new glass melting furnaces. New electric glass-melting furnaces are not subject to the NSPS for glass manufacturing plants and are likely, under the proposed NESHAP, to need controls to comply with the emission limit for new furnaces. The PM emission reduction from new electric glass-melting furnaces resulting from the proposed emission limit for new furnaces would be 160 Mg/yr (180 ton/yr) in the fifth year of the standard. Current nationwide emissions of metal HAPs from existing furnaces is 270 kg/yr (600 lb/yr). Under the proposed NESHAP, metal HAP emissions from existing furnaces and new furnaces would be reduced by 9 kg/

yr (20 lb/yr) and 2 kg/yr (5 lb/yr), respectively.

Nationwide emissions of formaldehyde from existing manufacturing lines are estimated to be 1,770 Mg/yr (1,950 ton/yr) at the current level of control. Emissions from RS manufacturing lines account for about 70 percent of the formaldehyde emissions. Implementation of the proposed NESHAP would reduce

nationwide formaldehyde emissions from existing sources by 410 Mg/yr (450 ton/yr). Emission reductions from RS manufacturing lines producing building insulation constitute the entire reduction; there would be no emission reductions from FA manufacturing lines because, under the proposed emission limits, no additional control of FA manufacturing lines is necessary and no new FA manufacturing lines are

anticipated. Reduction in formaldehyde emissions from new RS manufacturing lines is estimated to be 120 Mg/yr (130 ton/yr) in the fifth year of the standard. Nationwide baseline emissions and emission reduction estimates for glass-melting furnaces and manufacturing lines are summarized in metric units in Table 3(a) and in English units in Table 3(b).

TABLE 3(a).—NATIONWIDE ANNUAL EMISSIONS

[Metric units]

Source	Pollutant	Baseline emissions (Mg/yr)	Emission reduction (Mg/yr) ^a
Glass-Melting Furnaces	Metal HAP	0.3	0.01
	PM	750	760
RS Manufacturing Lines	Formaldehyde	1,220	530
FA Manufacturing Lines	Formaldehyde	550	0
All Sources	Total HAPs	1,770	530
	PM (Non-HAP)	750	760
	Total Pollutants	2,520	1,290

^a Emission reduction in the fifth year of the standard. Includes emission reductions from new sources.

TABLE 3(b).—NATIONWIDE ANNUAL EMISSIONS

[English units]

Source	Pollutant	Baseline emissions (ton/yr)	Emission reduction (ton/yr) ^a
Glass-Melting Furnaces	Metal HAP	0.3	0.01
	PM	830	840
RS Manufacturing Lines	Formaldehyde	1,350	580
FA Manufacturing Lines	Formaldehyde	600	0
All Sources	Total HAPs	1,950	580
	PM (Non-HAP)	830	840
	Total Pollutants	2,780	1,420

^a Emission reduction in the fifth year of the standard. Includes emission reductions from new sources.

An analysis of emissions from a medium-sized (27,200 Mg/yr [30,000 ton/yr] capacity) model electric furnace shows that metal HAP emissions would be reduced by about 0.001 Mg/yr (0.001 ton/yr) and PM emissions by an estimated 67 Mg/yr (74 ton/yr) from both an existing and a new electric furnace over an uncontrolled electric furnace. For a medium model plant (99,800 Mg/yr [110,000 ton/yr] capacity), metal HAP emissions from existing and new electric furnaces would be reduced by 0.004 Mg/yr (0.004 ton/yr) over a plant with uncontrolled electric furnaces; PM emissions would be reduced by an estimated 250 Mg/yr (270 ton/yr). Under the proposed NESHAP, there would be no emission reductions associated with existing gas-fired or cold top electric furnaces because all gas furnaces are already well controlled and no additional controls would be required for cold top electric furnaces to meet the proposed emission

limits. Because new gas furnaces would be controlled as a result of the NSPS for glass manufacturing sources (40 CFR part 60, subpart CC), no additional emission reductions from new gas furnaces would occur under the proposed NESHAP. As with existing cold top electric furnaces, new cold top electric furnaces would be able to meet the proposed emission limit without additional control.

Based on model line and plant analyses, formaldehyde emissions from a medium-sized (27,200 Mg/yr [30,000 ton/yr] capacity) RS manufacturing line producing building insulation would be reduced by an estimated 8 Mg/yr (9 ton/yr). Emissions of formaldehyde from a medium-sized plant (99,800 Mg/yr [110,000 ton/yr] capacity) containing two large RS manufacturing lines would be reduced by an estimated 30 Mg/yr (33 ton/yr). Formaldehyde emissions from a new RS manufacturing line would be reduced an estimated 33 Mg/

yr (37 ton/yr). No emission reduction would be achieved for new or existing medium-sized FA manufacturing lines producing pipe insulation since there would be no additional controls under the proposed NESHAP. The formaldehyde emission reduction from a new medium-sized (1,800 Mg/yr [2,000 ton/yr] production capacity) FA manufacturing line producing heavy-density products would total about 2.8 Mg/yr (3.1 ton/yr) although no new FA manufacturing lines are projected. Additional information on model plants and lines is included in the docket.

Because EPA proposes to regulate formaldehyde emissions as a surrogate measure for organic HAP emissions from manufacturing lines, only formaldehyde emissions data are presented here, although when the formaldehyde emission limit is met, phenol and methanol emissions will also be reduced. Where incineration is used to control formaldehyde emissions

from curing, emissions of phenol and methanol will also be controlled. Emissions data to quantify the degree of reduction in emissions of phenol and methanol as a result of increased levels of forming process modifications are not available. The results of emissions tests conducted at wool fiberglass manufacturing plants, including phenol and methanol test results, are contained in the docket.

C. Water Impacts

Because this standard is based on the use of baghouses, dry ESPs, thermal incinerators, and process modifications, there are no water pollution impacts. A few existing emission sources may use scrubbers to control HAP emissions although no additional sources are expected to add wet scrubbers for the control of HAP emissions. Therefore, no water impacts are expected from the proposed rule.

D. Solid Waste Impacts

The PM captured by the baghouses added to the seven uncontrolled electric furnaces will be recycled to the furnace and no solid or hazardous waste is generated by the use of thermal incinerators. No solid waste impacts are expected from the proposed rule.

E. Energy Impacts (Docket Item II-B-22)

Baghouses require electrical energy to operate fans. The additional electrical energy requirements are estimated to be 1.8 thousand megawatt hours per year (MWh/yr) over current requirements for seven additional baghouses to be added to existing sources. Emissions of PM associated with the additional energy requirements are estimated to be 0.1 ton/yr as compared to the PM emission reduction of 700 ton/yr estimated for installing the seven baghouses on uncontrolled furnaces. Projected new RS manufacturing lines would comply with the proposed standard for new sources using process modifications on forming and incinerators on curing. An additional 2.9 thousand MWh/yr for electricity and 290 billion Btu/yr of natural gas would be required for new incinerators although process modifications only may be used to comply with the proposed standard for new RS manufacturing lines. The total additional energy required as a result of this proposed NESHAP is 300 billion Btu/yr in the fifth year of the standard. No new FA manufacturing lines are projected; thus there are no increased energy requirements under the proposed standard for new FA manufacturing lines.

F. Nonair Environmental and Health Impacts

Reducing HAP levels may help lower occupational exposure levels and site-specific levels of PM and VOCs. New or upgraded process modifications for forming operations would decrease the quantity of HAP constituents in binder formulations. The addition of baghouses, ESPs, and incinerators may increase noise levels in the plant area due to the operation of pollution control devices where none are currently in place.

G. Cost Impacts

The EPA analyzed the cost impacts of the proposed standards for glass-melting furnaces by developing model lines based on site-specific information included in the ICR survey responses (docket item II-B-21) coupled with cost algorithms from the OAQPS Cost Manual (docket item II-A-3). The cost impacts of the proposed standards on wool fiberglass manufacturing facilities are based on estimates supplied by wool fiberglass companies for each of their manufacturing lines (docket item II-D-65).

The total nationwide capital and annual costs for existing glass-melting furnaces under the proposed NESHAP are \$3.2 million and \$1.5 million, respectively. This represents the cost of adding baghouses to seven electric glass-melting furnaces as well as the monitoring costs of bag leak detection systems installed on baghouses and temperature monitors installed on cold top electric furnaces. Control cost estimates assume the addition of pulse jet baghouses with polyester filter bags, an air-to-cloth ratio of 0.9 actual cubic meters per minute per square meter (3 acfm/ft²), and a pressure drop of 20 cm (8 in.) of water column. The estimated capital and annual costs of control equipment for a medium electric furnace (production capacity of 30,000 ton/yr) are \$432,000 and \$209,000, respectively. The capital cost includes the cost of the control device, auxiliary equipment, and installation, and retrofit costs. The model furnace cost estimates do not include the capital and annual costs for a bag leak detection system required on all baghouses under the proposed NESHAP. The EPA estimates the capital cost of this monitoring system to be approximately \$9,100 per furnace, with \$1,800/yr in annual costs. Cold top electric furnaces would incur costs for monitoring an operating parameter that gives an indication of furnace performance; for cost estimating purposes, the cost of monitoring the air temperature above the molten glass

surface was used. The estimated capital and annual costs of monitoring the temperature of cold top electric furnaces are \$1,500 and \$240, respectively. For ESPs, owners or operators are expected to monitor ESP parameters that they commonly monitor, such as secondary voltage, so that no additional monitoring costs would be incurred. Because the NSPS for glass manufacturing sources would regulate any new gas furnaces, there would be no additional control costs for new gas furnaces under the proposed NESHAP. The NSPS for glass manufacturing sources does not cover electric furnaces. Thus, under the proposed NESHAP, new electric furnaces will incur the cost associated with adding baghouses as well as bag leak detection monitoring systems. The capital and annual costs associated with a new baghouse would be \$288,000 and \$189,000, respectively in addition to the capital and annual costs of a bag leak detection system, \$9,100 and \$1,800, respectively.

Based on information supplied by the North American Insulation Manufacturers Association (NAIMA), 30 RS forming operations would upgrade their proprietary process modifications to meet the proposed emission limit for RS manufacturing lines; none of the existing curing ovens that are uncontrolled for HAPs would have to add an incinerator. No control costs are associated with complying with the proposed NESHAP for FA manufacturing lines. The proposed monitoring requirements for RS and FA manufacturing lines, i.e., monitoring resin free-formaldehyde content, product LOI and density, other process parameters, and incinerator operating temperature, are current industry practices and would not impose any additional costs. However, NAIMA estimates that there would be a one-time cost per line for testing that would be needed to establish a correlation between formaldehyde emissions and the process parameters to be monitored.

NAIMA estimated the costs of complying with the proposed standard for RS manufacturing lines for each of their lines. Capital costs per line ranged from \$150,000 to \$4 million and annual expenses per line ranged from \$100,000 to \$400,000. Nationwide capital costs of upgrading process modifications on 30 RS manufacturing lines were estimated at \$16.3 million with annual costs of \$4.8 million. Annual cost for new RS manufacturing lines is estimated to be \$0.9 million per line. No FA lines would require additional controls under the proposed standard and there would be no additional control costs. For all RS and FA manufacturing lines subject

to the standard, there would be a one-time cost of \$15,000 per line to establish the process parameter values for compliance monitoring. Because the process parameters that are likely to be used for compliance monitoring are ones that industry currently monitors, no additional costs will be incurred for monitoring beyond the one-time cost of \$15,000 per line.

Total nationwide capital costs for the standard are estimated at \$19.5 million and annual nationwide costs are estimated at \$6.3 million/yr, including installation, operation, and maintenance of emission control and monitoring systems.

H. Economic Impacts (Docket Item II-A-12)

The economic analysis of the proposed NESHAP finds impacts at the facility and market-level to be modest. The average market price increases for both structural and nonstructural wool fiberglass would be less than 0.5 percent. The resultant decreases in quantity demanded range from 0.17 percent for structural insulation markets to 0.22 percent for nonstructural insulation markets. None of the affected firms are classified as small businesses and no closures are predicted. For more detail, see the full economic impact analysis in the docket.

V. Selection of Proposed Standards

A. Selection of Source Category

Section 112(c) of the Act directs the Agency to list each category of major and area sources, as appropriate, emitting one or more of the 189 HAPs listed in section 112(b) of the Act. The EPA published an initial list of source categories on July 16, 1992 (57 FR 31576), and may amend the list at any time. "Wool Fiberglass Production" is one of the 174 source categories listed in the notice.

As defined in the EPA report, "Documentation for Developing the Initial Source Category List" (docket item II-A-5), the Wool Fiberglass Production source category includes any facility engaged in producing wool fiberglass from sand, feldspar, sodium sulfate, anhydrous borax, boric acid, or any other materials. Facilities that manufacture mineral wool from rock, slag, and other similar materials are not included in the source category. A separate MACT standard for mineral wool production is currently under development.

Before this project began, no formaldehyde test methods and no HAP data were available to assess the effectiveness of control devices in this

industry for controlling HAP emissions. The EPA and the wool fiberglass industry worked in a partnership to address the data needs for the purpose of establishing a MACT standard. Through a cooperative effort, EPA and NAIMA developed methods for measuring formaldehyde emissions from wool fiberglass manufacturing processes. Using information supplied voluntarily by industry for each wool fiberglass manufacturing line, EPA identified processes and control systems as candidates for emissions testing that were considered representative of the MACT floor and MACT for new sources. EPA and the industry were able to obtain the necessary emissions data as a result of these cooperative efforts.

Based on the information collected, EPA believes it is likely that all but three wool fiberglass plants are major sources subject to the proposed NESHAP. A major source must have the potential to emit 9.1 Mg/yr (10 ton/yr) or more of a single HAP or 23 Mg/yr (25 ton/yr) or more of a combination of HAPs. Three facilities (each with one line producing bonded products) may be area sources. At these sites, two of the three glass-melting furnaces and all three RS forming processes are controlled at the MACT floor level. Because these facilities are not believed to present an adverse environmental or health risk, EPA has determined that it is not necessary to include these wool fiberglass manufacturing facilities on the list of area sources required by section 112(c)(3) of the Act.

On December 3, 1993 (58 FR 63941), EPA published a schedule for the promulgation of standards for the sources selected for regulation under section 112(c) of the Act. According to this schedule, MACT standards for this source category must be promulgated no later than November 15, 1997. If standards are not promulgated by May 15, 1999 (18 months following the promulgation deadline), section 112(j) of the Act requires States or local agencies with approved permit programs to issue permits or revise existing permits containing either an equivalent emission limitation or an alternate emission limitation for HAP control. (See "Guidelines for MACT Determinations Under Section 112(j)," EPA 453/R-94-026, May 1994.)

B. Selection of Emission Sources

The wool fiberglass manufacturing source category, as defined in the EPA report, "Documentation for Developing the Initial Source Category List," includes, but is not limited to: (1) The glass-melting furnace, (2) marble forming, (3) refining unit, (4) fiber

formation process, (5) binder application process, (6) curing process, and (7) cooling process. For the reasons described below, EPA selected the forming, curing, and cooling processes on new and existing RS manufacturing lines and the forming and curing processes on existing FA manufacturing lines producing pipe insulation and on new FA manufacturing lines producing pipe insulation or heavy-density products for control under the proposed NESHAP. The proposed NESHAP also covers glass-melting furnaces located at wool fiberglass manufacturing facilities.

Glass-melting furnaces are generally large, shallow, and well-insulated vessels that are heated from above by gas burners or from within by electrical current. About 66 percent of the glass-melting furnaces used in the wool fiberglass industry are all-electric, about 25 percent are gas-fired and about 9 percent are a combination of gas and electric. Glass pull rates for furnaces range from 18 to 272 Mg/d (20 to 300 ton/d).

In the glass-melting furnaces, raw materials (e.g., sand, feldspar, sodium sulfate, anhydrous borax, boric acid) are introduced continuously or in batches on top of a bed of molten glass, where they mix and dissolve at temperatures ranging from 1,500 °C to 17,00 °C (2,700 °F to 3,100 °F), and are transformed by a series of chemical reactions to molten glass. Particulate emissions are caused by entrainment of dust from batch dumping and the combustion process and from volatilization of raw materials. Emissions of chromium result from entrainment of materials eroded from the refractory lining of the furnace and the furnace exhaust stack. Lead and arsenic are released from the batch materials and from the use of contaminated cullet (crushed recycled glass). Glass-melting furnaces may be either gas-fired, electric, or a combination of gas and electric. Emissions from glass-melting furnaces are typically controlled by baghouses or dry ESPs. One type of electric furnace, the cold top electric furnace, has low PM emissions without add-on controls as a result of its design. Operators of these units maintain a thick crust of raw materials on top of the molten glass, which impedes the release of heat and keeps the air temperature above the molten glass at or below 120 °C (250 °F).

One of two methods may be used for the next stage of the process, fiber formation. In an RS forming process, a regulated flow of molten glass enters the center of a rotating spinner. Spinners are in a linear arrangement, with 2 to 12 spinners on a single line. Centrifugal action forces the molten glass out of the

spinners through hundreds of small orifices in the spinner wall to form glass threads. As the threads exit the spinner, a high-velocity air jet or a mixture of air and natural gas flame forces the threads downward, which attenuates the threads to form glass fibers.

In the FA forming process, also known as the "pot and marble" process, glass marbles that were produced at separate on- or offsite facilities are fed into ceramic pots (typically 6 to 28 pots per line) that are heated to a high temperature. Glass strands flow by gravity down through holes in the bottom of the pot and are directed by pinch rollers. Following the pinch rollers, a high-velocity, high-temperature mixture of air and gas flame is used to attenuate the fibers. Particulate and organic emissions are released during the fiber-forming process due to volatilization of raw materials and entrainment of fiberglass particles in the process air stream.

After the fibers are formed, they are sprayed with a binder. A typical binder consists of phenol-formaldehyde resin, water, urea, lignin, silane, and ammonia. The binder composition used in the RS and FA forming process is similar. Air, at a flow rate ranging from about 430 to 5,100 actual cubic meters per minute (15,000 to 180,000 acfm), forces the fibers downward onto a continuously moving conveyor to form a mat, which is conveyed to the curing oven. Emissions of formaldehyde, phenol, and methanol occur as a result of the vaporization of the volatile binder as it comes in contact with hot fibers and as a result of binder that is not deposited on the mat but passes through the conveyor and is exhausted to the atmosphere. HAP emissions from forming are controlled by process modifications, such as resin and binder chemistry and fiberization technology.

The curing oven drives off moisture remaining on the fibers and sets the binder. The temperature of the curing oven varies for each product, ranging from about 180 °C to 320 °C (350 °F to 600 °F). Fans are used to draw hot air through the mat within each of the oven zones; the hot air may be recycled within each zone to conserve energy. The total air flow exiting the oven ranges from about 200 to 850 actual cubic meters per minute (7,000 to 30,000 acfm) for the RS process and from 85 to 480 actual cubic meters per minute (3,000 to 17,000 acfm) for the FA process. Emissions of formaldehyde, phenol, and methanol are the result of vaporization of volatile compounds in the binder. Emissions from about one-third of the curing ovens on RS manufacturing lines are controlled by

thermal incinerators; the remainder are uncontrolled for organic HAP emissions. None of the curing ovens on FA manufacturing lines are controlled for organic HAPs.

The quantity of binder solids sprayed onto the glass fibers is governed by the type of product being manufactured. Typically, about 70 percent of the binder applied to the fiberglass remains on the product. The remainder remains on the conveyor and is recycled back into the process via the wash water or is exhausted with the forming or curing oven air. Quality control checks are routinely performed to determine the product LOI, which ensures that the correct weight percent of binder is present in the product.

After curing, the fiber mat is conveyed to a cooling section, where ambient air is forced through the mat to eliminate "hot spots" in the product and to facilitate finishing and packaging. Cooling air flow rates range from 140 to 990 actual cubic meters per minute (5,000 to 35,000 acfm). By the time the mat with its thermally set binder reaches cooling, emissions of formaldehyde, phenol, and methanol are relatively small compared to forming and curing. Cooling processes are not controlled for HAP emissions. Most FA manufacturing lines do not have cooling sections because the product is able to cool adequately between exiting the curing oven and reaching the finishing and handling sections.

At the current level of control, existing glass-melting furnaces emit approximately 270 kg/yr (600 lb/yr) of HAP and 750 Mg/yr (830 ton/yr) of PM. Under the proposed NESHAP, EPA expects that seven currently uncontrolled electric furnaces would install controls. Electric furnaces (excluding cold top electric furnaces) emit an estimated 9 kg/yr (20 lb/yr) of HAP and about 635 Mg/yr (700 ton/yr) of PM. Control of these furnaces would ensure that all furnaces are controlled to the MACT floor emission level.

Existing cold top electric furnaces (air temperature above the molten glass of 120 °C [250 °F] or less) are not equipped with add-on control devices. Particulate emissions from the 12 existing cold top electric furnaces are limited by the thick crust maintained on the molten glass surface. Emissions are estimated to be 27 kg/yr (60 lb/yr) of HAP and about 55 Mg/yr (60 ton/yr) of PM. These furnaces are expected to comply with the proposed emission limit without the need for add-on control devices. The EPA considered requiring controls for cold top electric furnaces and has determined that the cost effectiveness of

additional controls beyond the floor is not reasonable.

Manufacture of wool fiberglass releases an estimated 1,770 Mg/yr (1,950 ton/yr) of formaldehyde from RS and FA manufacturing lines. The Agency selected forming, curing, and cooling processes on all new and existing RS manufacturing lines and forming and curing processes on existing FA manufacturing lines producing pipe insulation and new FA manufacturing lines producing pipe insulation or heavy-density products for control under the proposed NESHAP. Because no controls are currently used, the MACT floor is no control and because the cost effectiveness of additional controls beyond the floor is not reasonable, the Agency is not setting emission limits for existing FA manufacturing lines producing light-density, automotive, or heavy-density products or new FA manufacturing lines producing light-density or automotive products. Because no plants have equipped forming or curing processes on these manufacturing lines with emission controls, the MACT floor is no control. The EPA considered beyond-the-floor controls for both RS and FA manufacturing lines and has determined that the cost effectiveness of additional controls does not justify going beyond the floor.

C. Selection of Pollutants

The EPA proposes to regulate emissions of formaldehyde, a HAP and surrogate for phenol and methanol emissions, and PM emissions, a surrogate for metal HAP emissions. Formaldehyde, phenol, methanol, and the metal HAPs are included on the list of HAPs under section 112(b) of the Act and are emitted from wool fiberglass manufacturing sources.

Formaldehyde is the only organic HAP emitted from the wool fiberglass industry that has been identified to be a potential carcinogen. EPA proposes to regulate emissions of formaldehyde, phenol, and methanol using formaldehyde as a surrogate measure for the proposed emission limits for manufacturing lines. Use of formaldehyde as a surrogate allows a single emission limit rather than individual emission limits for formaldehyde, phenol, and methanol (which would require separate measurements) because when the formaldehyde emission limit is met, phenol and methanol emissions will also be reduced.

D. Selection of Proposed Standards for Existing and New Sources

1. Background

After EPA has identified the specific source categories or subcategories of major sources to regulate under section 112, MACT standards must be set for each category or subcategory. Section 112 establishes a minimum baseline or "floor" for standards. For new sources, the standards for a source category or subcategory cannot be less stringent than the emission control that is achieved in practice by the best-controlled similar source. [See section 112(d)(3).] The standards for existing sources can be less stringent than standards for new sources, but they cannot be less stringent than the average emission limitation achieved by the best-performing 12 percent of existing sources for categories and subcategories with 30 or more sources, or the best-performing five sources for categories or subcategories with fewer than 30 sources.

After the floor has been determined for a new or existing source in a source category or subcategory, the Administrator must set MACT standards that are no less stringent than the floor. Such standards must then be met by all sources within the category or subcategory. In establishing the standards, EPA may distinguish among classes, types, and sizes of sources within a category or subcategory. [See section 112(d)(1).]

The next step in establishing MACT standards is to investigate regulatory alternatives. With MACT standards, only alternatives at least as stringent as the floor may be selected. Information about the industry is analyzed to develop model plants for projecting national impacts, including HAP emission reduction levels and cost, energy, and secondary impacts. Regulatory alternatives (which may be different levels of emissions control, equal to or more stringent than the floor levels) are then evaluated to select the regulatory alternative that best reflects the appropriate MACT level. The selected alternative may be more stringent than the MACT floor, but the control level selected must be technologically achievable. The regulatory alternatives and emission limits selected for new and existing sources may be different because of different MACT floors.

The Agency may consider going beyond the floor to require more stringent controls. Here, EPA considers the achievable emission reductions of HAPs (and possibly other pollutants that are co-controlled), cost and

economic impacts, energy impacts, and other nonair environmental impacts.

The objective is to achieve the maximum degree of emissions reduction without unreasonable economic or other impacts. [See section 112(d)(2).] Subcategorization within a source category may be considered when there is enough evidence to demonstrate clearly that there are significant differences among the subcategories.

The EPA examined the processes, the process operations, and other factors to determine if separate classes of units, operations, or other criteria have an effect on air emissions or their controllability. The EPA considered developing subcategories of glass-melting furnaces on the basis of the energy sources used to convert the raw materials to molten glass and their emission potential. Glass-melting furnaces are typically either gas-fired, electric, or a combination of gas and electric. After examining PM emissions data for gas, electric, and combination gas and electric furnaces, EPA concluded that there is a large amount of variability in PM emissions regardless of energy source and that most furnaces are already well controlled by either ESPs or baghouses. Therefore, EPA decided not to develop subcategories of glass-melting furnaces.

Wool fiberglass manufacturing lines can be classified by the type of forming process (RS and FA) used. Approximately 90 percent of the wool fiberglass manufactured by the RS forming process is building insulation, whereas the wool fiberglass manufactured by the FA forming process is specialty products, such as automotive or filtration products. Because of the type of products, the RS and FA forming process differ significantly in the way fibers are formed, production rates, air flow and energy expended per ton of product, application of process modifications, and the amount of binder applied to the wool fiberglass. As a result of these differences in manufacturing methodologies, levels of pollutant emissions, and application of controls (such as process modifications), EPA subcategorized manufacturing lines into those using the RS forming process (RS manufacturing lines) and those using the FA forming process (FA manufacturing lines). RS manufacturing lines consist of forming, curing, and cooling. FA manufacturing lines consist of forming and curing processes; cooling is not a distinct separate process on FA manufacturing lines. FA manufacturing lines can be further subcategorized by the type of specialty product made. The FA subcategories include light-density,

heavy-density, automotive, and pipe insulation products. Each of these subcategories is characterized by a specific range of LOIs and densities, which gives each subcategory a different emission potential. Also, the control measures that can be used to reduce HAP emissions, for example, process modifications, are different for the FA subcategories. For all these reasons, the proposed standards have different emission limits for RS manufacturing lines and FA manufacturing lines and, within the FA subcategory, different emission limits for two FA subcategories.

2. Selection of Floor Technologies

In establishing these proposed emission standards, the add-on or process control technology representative of the MACT floor was determined for each subcategory. In general, these determinations were made on the basis of the performances of the technologies as reported by emission test results. The technologies determined to be the MACT floors are those determined to be the median of the technologies that are representative of the best performing 12 percent of the sources (for which there are emissions data) where there are more than 30 sources in the subcategory or the best performing five sources (for which there are emissions data) where there are fewer than 30 sources.

Of the 56 existing glass-melting furnaces, 12 are controlled by ESPs and 25 by baghouses (more than one furnace may be controlled by a single control device). PM emissions data are available for 18 furnaces. Because the number of furnaces is greater than 30, the MACT floor is represented by the average of the best performing 12 percent of the existing sources. Based on PM emissions data for the best performing 12 percent, baghouses and ESPs are equally effective in controlling PM emissions from glass-melting furnaces. Therefore, the MACT floor for existing glass-melting furnaces is represented by well-designed and operated baghouses and ESPs. An ESP representative of the MACT floor will have a specific collection area of 32 square meters per 1,000 actual cubic meters per hour (590 ft²/1,000 acfm); a baghouse representative of the MACT floor is a pulse-jet baghouse with polyester bag material and an air-to-cloth ratio of 0.9 actual cubic meters per minute per square meter (3 acfm/ft²). Because the same well-designed and -operated baghouses and ESPs are considered by EPA to be the best control technology for PM emissions, including metal HAP emissions, MACT for new furnaces

would be the same as the MACT floor for existing sources, a baghouse or an ESP.

HAP emissions control on RS forming processes is achieved by process modifications including resin and binder chemistry, fiberization technology, binder application, and forming conditions (docket item II-D-62). Resins are manufactured by an outside supplier or in-house using proprietary technologies to meet the specifications of the wool fiberglass manufacturer. Variables, such as the phenol-to-formaldehyde mole ratio, resin cook procedures, and catalysts, control both the free-formaldehyde and phenol levels as well as the types and relative percentage of phenol oligomers, all of which influence the levels of emissions and acceptability of a resin for a given process. Resin purchase specifications are typically written so that the free-formaldehyde content is "not to exceed" a certain level. In binder chemistry, the addition of various additives can reduce formaldehyde emissions. Urea, for example, added to the binder solution reacts with free formaldehyde, which can form stable, nonreversible urea formaldehyde compounds. In fiberization technology, temperature of the fiber veil is a critical process variable (a lower temperature may reduce HAP volatilization) affected by the fiberizer design and operation as well as by air and water treatment of the fiber veil. Binder application efficiency, the amount of binder that stays on the fiberglass, is increased by matching binder droplet size to the fiber diameter. Factors such as nozzle size geometry, configuration of the nozzle assembly, and location affect binder droplet size. Forming conditions, such as air volume and velocity affect binder application efficiency; too much or too little air flow can increase emissions. Each of these process modifications has been implemented on each of the 40 RS forming processes, although the degree to which each process modification has been implemented is different for each line. Add-on controls such as wet scrubbers or wet ESPs, primarily for PM control, were shown to be ineffective for gaseous HAP removal. Thus, the MACT floor for forming on existing RS manufacturing lines is represented by process modifications. Because the number of RS forming sources, 40, is greater than 30, the MACT floor is represented by the median of the best performing 12 percent of existing sources, or five sources ($40 \times 0.12 = 4.8$). Based on HAP emissions data for the best performing 12 percent of existing

sources, process modifications are the MACT floor for forming processes on RS manufacturing lines. Because of differences in application between companies and because of the proprietary nature of process modifications, a detailed description of forming process modifications cannot be presented.

Of the 43 curing ovens on RS manufacturing lines, 14 are controlled using incinerators. Based on the median of the top 12 percent, the thermal incinerator is the MACT floor for curing processes on existing RS manufacturing lines. Thermal incinerators have been shown to be highly effective in the control of emissions of organic HAPs and can achieve destruction efficiencies in excess of 98 percent with an adequately high temperature, good mixing, sufficient oxygen, and adequate residence time. Low organic concentration gas streams, such as those emitted from wool fiberglass curing processes, can be expected to have low heating values and require auxiliary fuel. Heat recovery through the use of a recuperative incinerator can reduce the energy requirements. Emission test measurements demonstrate that a thermal incinerator is at least 99 percent effective in the removal of formaldehyde and phenol from curing ovens. Based on the median of the best performing 12 percent of existing sources, a thermal incinerator representative of the MACT floor has a combustion temperature of 700 °C (1,300 °F) and a gas residence time of 1 second.

While the MACT floor for cooling is no control, cooling is included in the definition of RS manufacturing line, and therefore covered as part of the proposed RS manufacturing line standard. This inclusion prevents the shifting of emissions from forming and curing to the cooling section.

The EPA's analysis of MACT floor control options for existing RS manufacturing lines (described above) showed that the median of the best performing 12 percent of existing forming processes control HAP emissions using process modifications and the median of the best performing 12 percent of existing curing ovens are controlled by incinerators. As a result, the MACT floor for RS manufacturing lines is forming process modifications coupled with an incinerator for curing emissions. These controls were determined to be the most efficient for the control of HAPs among the various controls used in the industry for existing RS manufacturing lines. Based on the best controlled source, MACT for new RS manufacturing lines is more stringent than the MACT floor for

existing RS manufacturing lines. MACT for new RS forming processes incorporates a higher degree of process modifications than is present on most existing forming processes but which is available to all the industry and can be designed into new forming processes. Because the MACT floor for existing curing ovens, incinerators operating at 700 °C (1,300 °F) and a gas residence time of 1 second, represent the best-controlled source, MACT for new curing ovens is the same as the MACT floor for existing curing ovens. None of the cooling processes are controlled for gaseous HAPs; as a result, MACT for new cooling processes is no control. Thus, EPA has determined that the MACT floor for new RS manufacturing lines is represented by a high level of process modifications on RS forming processes, incinerators on curing ovens, and no control on cooling processes.

As discussed earlier, none of the forming processes on FA manufacturing lines producing light-density or automotive products are equipped with HAP emission controls. Thus, the MACT floor is no control for forming processes on new and existing FA lines producing these products. The median of the best performing five lines (fewer than 30 sources) producing heavy-density products was determined to be no control; thus, the MACT floor for forming on existing FA manufacturing lines producing heavy-density products is no control. The best-controlled heavy-density forming process uses process modifications; therefore, process modifications are the basis for the MACT floor for the forming process on new FA manufacturing lines producing heavy-density products.

Emissions from the forming process on all FA manufacturing lines producing pipe insulation are controlled by the same level of process modifications. Therefore, process modifications are the basis for the MACT floor for the forming process on all new and existing FA manufacturing lines producing pipe insulation.

No control systems have been applied for the control of HAP emissions from curing ovens on FA manufacturing lines. Therefore, the MACT floor for curing ovens on new and existing FA manufacturing lines is no control. Although the MACT floor for curing is no control, curing is included in the definition of FA manufacturing line and, therefore, is covered as part of the proposed FA manufacturing line standard. This inclusion prevents the shifting of emissions from forming to the curing section.

The EPA's analysis of MACT floor control options for existing FA

manufacturing lines producing pipe product showed the best performing five forming processes (fewer than 30 sources) controlled by the same level of process modifications and curing ovens uncontrolled for HAP emissions. As a result, the MACT floor for existing FA manufacturing lines producing pipe products is process modifications and no control for curing. Because the same level of process modifications is used on forming processes on all FA manufacturing lines producing pipe products and because no HAP controls are used on curing ovens, EPA has determined that the MACT floor for new FA manufacturing lines producing pipe products is the same as the MACT floor for existing sources.

As described above, the MACT floor for forming processes and curing ovens on existing FA manufacturing lines producing heavy-density products is no control; therefore, the MACT floor for existing FA manufacturing lines producing heavy-density products is no control. Based on the best-controlled source, MACT for new FA manufacturing lines producing heavy-density products is process modifications on forming. Because no curing ovens are controlled, the MACT floor for new curing ovens is no control, the same as the MACT floor for existing curing ovens. Thus, EPA has determined that the MACT floor for new FA manufacturing lines that produce heavy-density products is represented by process modifications on forming and no control on curing ovens.

The EPA considered requiring controls beyond the MACT floor for glass-melting furnaces and RS and FA manufacturing lines. However, based on an assessment of the impacts of beyond-the-floor controls, EPA concluded that the cost effectiveness of an incremental reduction in emissions would make additional controls unreasonable (docket items II-A-12, II-B-17, II-B-22).

3. Emission Limits

As part of this rulemaking, emissions data were collected from tests at 10

wool fiberglass plants and from other test data supplied by NAIMA to characterize uncontrolled and controlled emissions from the various processes and evaluate the effectiveness of existing control systems. Sites tested during this rulemaking were selected based on their use of the control technology identified as candidates for MACT floor. Using the test data, EPA established the MACT floor emission limits for existing and new sources.

Emissions data were evaluated for 18 furnaces controlled by baghouses and ESPs (docket item II-I-20). Emissions ranged widely for both gas and electric furnaces and for both well-designed and well-operated baghouses and ESPs. Controlled PM emissions from all furnaces ranged from 0.01 to 0.54 kg/Mg (0.02 to 1.08 lb/ton) of glass pulled. Emissions of PM from baghouse-controlled furnaces ranged from 0.01 to 0.54 kg/Mg (0.02 to 1.08 lb/ton) of glass pulled and from 0.01 to 0.25 kg/Mg (0.02 to 0.5 lb/ton) of glass pulled for ESP-controlled furnaces. Controlled electric furnace PM emissions ranged from 0.01 to 0.35 kg/Mg (0.02 to 0.7 lb/ton) of glass pulled; controlled gas furnace emissions ranged from 0.01 to 0.54 kg/Mg (0.02 to 1.08 lb/ton). In proposing emission limits, EPA took into consideration the wide variation in controlled emissions for both gas and electric furnaces and for well-designed and operated baghouses and ESPs. The proposed PM emission limits represent a level that can be achieved by all existing furnaces that are controlled by well-designed and operated baghouses and ESPs. Because MACT for new and existing furnaces is the same, EPA proposed the same PM emission limit, 0.25 kg of PM/Mg (0.5 lb of PM/ton) of glass pulled, for new furnaces as for existing furnaces. The proposed PM emission limit for existing glass-melting furnaces, 0.25 kg/Mg (0.5 lb/ton) of glass pulled, is the same as the current NSPS level for gas-fired glass-melting furnaces in the wool fiberglass industry (see 40 CFR part 60, subpart CC). Both baghouses and ESPs are used to control emissions from gas-fired furnaces. In

proposing the same emission limit for new and existing furnaces, EPA recognizes that both baghouses and ESPs used on existing furnaces are already highly efficient at controlling PM emissions and there is no basis for a more stringent emission limit based on this control technology.

The limited emission test data for metal HAPs show their emissions to be low, often below the detection limits of the test method. In cooperative efforts by EPA and NAIMA, tests for metal HAPs were performed at six glass-melting furnaces (docket item II-B-15). For a medium capacity controlled furnace (27,000 Mg/yr [30,000 ton/yr]), emissions of arsenic would be 0.2 lb/yr, chromium emissions would range from 1.2 to 18 lb/yr, and lead emissions would be 0.6 to 2.1 lb/yr. Total metal HAP emissions from a large (50,000 Mg/yr [55,000 ton/yr]) controlled model gas-fired furnace are an estimated 60 lb/yr.

For RS forming processes, the number of sources is 40. Because the number of sources is greater than 30, the MACT floor is represented by the median of the best performing 12 percent of existing sources, or five sources. Emissions of formaldehyde from forming processes representative of the best performing five were measured (docket items II-B-15, II-B-21, II-D-64). Emissions of formaldehyde from these five forming processes were 0.15, 0.33, 0.49, 0.49, and 0.6 kg/Mg (0.3, 0.65, 0.97, 0.97, and 1.2 lb/ton) of glass pulled. Using these results, the median emission level is 0.49 kg of formaldehyde per megagram (0.97 lb of formaldehyde per ton) of glass pulled. The emission level selected as representative of new forming processes, 0.33 kg of formaldehyde per megagram (0.65 lb of formaldehyde per ton) of glass pulled, reflects the performance of the best process modification available to the industry. The emission level of 0.15 kg/Mg (0.3 lb/ton) is from a proprietary forming process not available to the rest of the industry. Therefore, it was not considered MACT for new sources. Emissions test results for RS forming processes are summarized in Table 4.

TABLE 4.—SUMMARY OF EMISSION TEST RESULTS ON RS MANUFACTURING LINES

[Docket Items II-B-15, II-B-21, II-D-64]

Process and Plant	Control	Average Formaldehyde Emissions	
		kg/mg	lb/ton
Forming	Process modifications ^a		
Plant P	0.15	0.3
Plant S	0.33	0.65
Plant T	0.6	1.2
Plant U	0.49	0.97

TABLE 4.—SUMMARY OF EMISSION TEST RESULTS ON RS MANUFACTURING LINES—Continued
[Docket Items II-B-15, II-B-21, II-D-64]

Process and Plant	Control	Average Formaldehyde Emissions	
		kg/mg	lb/ton
Plant V .....	.....	0.49	0.97
Curing			
Plant M	Incinerator (1300 °F, 0.5-s residence time)		
	Inlet	0.497	0.994
	Outlet	0.00039	0.00078
Plant N	Incinerator (1500 °F, 2.5-s residence time)		
	Outlet	0.00146	0.00292
Cooling			
Plant O	Uncontrolled	0.004	0.007

^a Process modifications include resin chemistry, binder chemistry, fiberization technology, binder application, forming conditions.

RS curing processes, controlled by incinerators, were tested at two plants using the technology that EPA determined represented the MACT floor for RS curing, resulting in one measurement of 0.0004 kg of formaldehyde per megagram (0.001 lb of formaldehyde per ton) of glass pulled and another measurement of 0.0015 kg of formaldehyde per megagram (0.003 lb of formaldehyde per ton) of glass pulled (docket item II-B-15). Because results from just two tests were available, the higher result (0.0015 kg of formaldehyde per megagram [0.003 lb of formaldehyde per ton] of glass pulled) was chosen to represent MACT floor emissions from existing and new curing ovens. The only test result for emissions from cooling operations was 0.005 kg of formaldehyde per megagram (0.01 lb of formaldehyde per ton) of glass pulled (docket item II-B-15); this emission level was selected to represent the emissions from new and existing cooling processes. Emissions data for RS curing and cooling processes are summarized in Table 4.

The proposed formaldehyde emission limit for existing RS manufacturing lines, 0.6 kg of formaldehyde per megagram (1.2 lb of formaldehyde per ton) of glass pulled, is based on the combined manufacturing line emission levels from forming, curing, and cooling with a 20 percent allowance to account

for the use of short-term test data as compared to long-term continuous monitoring data. In metric units, the emission limit for existing RS manufacturing lines was calculated as follows: $(0.49 + 0.0015 + 0.005) \times 1.20 = 0.6$ kg of formaldehyde per megagram of glass pulled. In English units, the emission limit for existing RS manufacturing lines was calculated as follows: $(0.97 + 0.003 + 0.01) \times 1.20 = 1.2$ lb of formaldehyde per ton of glass pulled. The proposed emission limit for new RS manufacturing lines, 0.4 kg of formaldehyde per megagram (0.8 lb of formaldehyde per ton) of glass pulled, was derived using 0.33 kg/Mg (0.65 lb/ton) for the forming emission level and the same emission levels for curing and cooling as mentioned above. In metric units, the emission limit for new RS manufacturing lines was calculated as follows: $(0.33 + 0.0015 + 0.005) \times 1.20 = 0.4$ kg of formaldehyde per megagram of glass pulled. In English units, the emission limit for new RS manufacturing lines was calculated as follows: $(0.65 + 0.003 + 0.01) \times 1.20 = 0.8$ lb of formaldehyde per ton of glass pulled.

For existing and new FA manufacturing lines that produce pipe insulation, the MACT floor for forming is the same process modification, which has been applied to an equal degree to all forming processes. Because there are

no formaldehyde emission controls on curing on FA manufacturing lines producing pipe insulation, the MACT floor for curing is no control. Emissions of formaldehyde have been measured from forming and curing on six FA manufacturing lines producing pipe insulation where the same MACT floors for forming and curing were used (see Table 5). Results from short-term formaldehyde emission tests on these FA manufacturing lines were 1.7, 2.4, 2.4, 2.4, 3.2 and 3.4 kg/Mg (3.4, 4.7, 4.8, 4.9, 6.5, and 6.8 lb/ton) of glass pulled (docket item II-D-54). Even though the same control technologies and methods on manufacturing lines (forming and curing) producing the same product were used, the emissions varied widely from 3.4 to 6.8 lb/ton. Because the test data for the same control technologies and methods that represent the MACT floors show a range of emissions and because emissions tests used short term tests (3 hrs) while the MACT standard will need to be met at all times, EPA has set the proposed formaldehyde emission limit for new and existing FA manufacturing lines producing pipe insulation at 3.4 kg of formaldehyde per megagram (6.8 lb of formaldehyde per ton) of glass pulled. The EPA believes that this emission rate is the level that can be consistently achieved by the control technologies and methods that are the MACT floor.

TABLE 5.—SUMMARY OF EMISSIONS DATA FOR FA MANUFACTURING LINES
[Docket item II-D-54]

Process and product	Control	Formaldehyde emissions	
		kg/mg	lb/ton
Heavy density	Forming—process modifications	2.3	4.6
	Curing—no control	3.9	7.8

TABLE 5.—SUMMARY OF EMISSIONS DATA FOR FA MANUFACTURING LINES—Continued
[Docket item II-D-54]

Process and product	Control	Formaldehyde emissions	
		kg/mg	lb/ton
Pipe	Forming—process modifications	1.7	3.4
	Curing—no control	2.35	4.7
		2.4	4.8
		2.45	4.9
		3.25	6.5
		3.4	6.8

In the case of new FA manufacturing lines that produce heavy-density product, the MACT floor is represented by process modifications on forming processes, which have been applied to the same degree on two forming processes, and no control on curing. The emission limit selected for new FA manufacturing lines producing heavy-density product is based on the results of emissions testing on forming and curing processes on two FA manufacturing lines producing heavy-density products where the same process modifications have been applied to forming and both curing ovens are uncontrolled (see Table 5). Emissions of formaldehyde from these two FA manufacturing lines were 2.3 and 3.9 kg of formaldehyde per megagram (4.6 and 7.8 lb of formaldehyde per ton) of glass pulled (docket item II-D-54). Because of the small number of tests, the use of short-term test data (rather than long-term continuous monitoring data), and to allow for the variability in emission results from forming processes using the same floor level process modifications, the 3.9 kg/Mg (7.8 lb/ton) level was chosen to represent MACT floor emissions from new FA manufacturing lines manufacturing heavy-density products.

E. Selection of

Monitoring Requirements

Several monitoring options were identified and evaluated for sources in wool fiberglass manufacturing facilities. Under the most stringent option, a continuous opacity monitor (COM) would be required for monitoring PM emissions from glass-melting furnaces, and a continuous emission monitor (CEM) would be required for measurements of formaldehyde, phenol, and methanol. No EPA-approved continuous monitoring method is available for measuring PM, which is used as a surrogate for metal HAP emissions.

Where continuous monitors do not exist or are too expensive, monitoring would rely on parametric monitoring of one or more parameters associated with the production process or control device, coupled with corrective action for operating problems. Potential parameters could include incinerator operating temperature, ESP electrical readings, and binder formulation parameters. A bag leak detection system could be used to monitor PM emissions from baghouses and ensure proper operation and maintenance of the control devices. Visible emissions observations by Method 9 could be required on a daily or weekly basis to ensure proper operation of control devices on glass-melting furnaces. For this industry, however, opacity is not considered a good indicator of compliance because of the low grain loadings. Therefore, this option was not considered further.

A one-time performance test is necessary to demonstrate compliance with the applicable emission limit for glass-melting furnaces and manufacturing lines. Using the surrogate approach, the owner or operator would measure PM emissions from the furnace control system using EPA Method 5 in appendix A to 40 CFR part 60 and § 63.1389 (Test methods and procedures) and formaldehyde emissions using EPA Method 316 or Method 318. Methods 316 and 318 are also being proposed today. The sampling and analytical cost for a three-run performance test is estimated at \$8,000 for Method 5 and \$9,000 for Method 316. The owner or operator could also use EPA Method 318, for measuring formaldehyde emissions for compliance purposes as well measuring other pollutant emissions. The method is also validated for use as a CEM. The sampling and analytical cost for three Fourier Transform Infrared (FTIR) gas-phase extractive runs, including other tests needed in conjunction with Method 318, is about \$15,000.

During the performance tests for each glass-melting furnace and each RS and FA manufacturing line subject to the standard, the owner or operator would monitor and record the glass pull rate and determine the arithmetic mean for each test run. A determination of compliance during the performance tests would be based on the average of the three individual test runs.

Each owner or operator subject to the proposed NESHAP would submit a written operations, maintenance, and monitoring plan as part of their application for a part 70 permit. The plan would include procedures for the proper operation and maintenance of processes and add-on control devices used to comply with the proposed emission limits as well as the corrective actions to be taken when a process or control device parameter deviates from allowable levels established during performance testing. The plan would identify the process parameters and control device parameters that would be monitored to determine compliance, a monitoring schedule, and procedures for keeping records to document compliance. Additional information may be required depending on the add-on control device or process that is used to comply with the emission standard.

The owner or operator of each furnace controlled by an ESP would submit as part of their operations, maintenance, and monitoring plan the ESP parameters (e.g., secondary voltage of each electrical field) to be monitored, a monitoring schedule, recordkeeping procedures to document compliance, and how the ESP is to be maintained and operated. The proposed monitoring provisions specify that corrective actions be taken according to the procedures in the operations, maintenance, and monitoring plan in the event of a deviation in any 3-hour average ESP parameter outside the range established during performance testing. Failure to initiate corrective actions within 1 hour of the deviation would be considered noncompliance. If the ESP

parameter values are outside the range established during the performance test for more than 5 percent of total operating time in a 6-month reporting period, the owner or operator would implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.⁷ If the ESP parameter values are outside the range for more than 10 percent of total operating time in a 6-month reporting period, the owner or operator would be in violation of the standard.

Following the performance test, the owner or operator of each glass-melting furnace controlled by a baghouse would monitor emissions exiting the PM control system using a bag leak detection system since opacity is not a good indicator of performance at the low, controlled PM levels characteristic of these sources. The bag leak detection system must be equipped with an alarm system that will sound when an increase in PM emissions is detected. On a positive pressure baghouse where more than a single bag leak detection system probe may be necessary, the instrumentation and alarm for the bag leak detection system may be shared among detectors. Provisions are included in the rule regarding installation, calibration, and operation of the system. The monitoring provisions specify that when the bag leak detection system alarm is activated, the baghouse be inspected for the cause of the alarm and that corrective action be initiated according to the procedures in the operations, maintenance, and monitoring plan. Failure to initiate corrective actions within 1 hour of the alarm would be considered noncompliance. If the alarm is activated for more than 5 percent of the total operating time during the 6-month reporting period, the owner or operator must implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.⁸

The owner or operator of a glass-melting furnace whose emissions are not exhausted to an air pollution control device for PM control would submit as part of their operations, maintenance, and monitoring plan a description of how the furnace is to be operated and maintained, the furnace parameter(s) to be monitored for compliance purposes, a monitoring schedule, and recordkeeping procedures for documenting compliance. On cold top electric furnaces, for example, the air temperature above the glass melt may be

monitored as an indicator of furnace performance. Corrective action would be taken if the range of acceptable values for the selected operating parameter(s), such as air temperature above the glass melt in a cold top electric furnace, established during the initial performance test, is exceeded based on any 3-hour average of the monitored parameter. A deviation outside the established range would trigger an inspection of the glass-melting furnace to determine the cause of the deviation and the initiation of corrective actions according to the procedures in the facility's operations, maintenance, and monitoring plan. Failure to initiate corrective actions within 1 hour of the deviation would be considered noncompliance. If the furnace operating parameter values are outside the range established during the performance test for more than 5 percent of total operating time in a 6-month reporting period, the owner or operator would implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.⁹ If the furnace parameter values are outside the range for more than 10 percent of total operating time in a 6-month reporting period, the owner or operator would be in violation of the standard.

The owner or operator would perform the one-time performance test for each new and existing RS manufacturing line that produces building insulation (defined as having an LOI of less than 8 percent and a density of less than 32 kg/m³ [2 lb/ft³]) while manufacturing building insulation. Similarly, performance tests would be performed for each new FA manufacturing line that produces heavy-density (defined as having an LOI of 11 to 25 percent and a density of 8 to 48 kg/m³ [0.5 to 3 lb/ft³]) or pipe insulation products (defined as having an LOI of 8 to 14 percent and a density of 48 to 96 kg/m³ [3 to 6 lb/ft³]) and each existing FA manufacturing line that produces pipe insulation products.

During the performance test on RS and FA manufacturing lines, the owner or operator would monitor and record the free-formaldehyde content of each resin lot, the binder formulation of each batch used during the tests, and the product LOI and density for each line tested. The performance test would be run using the resin with the highest free formaldehyde content that is expected to be used on each manufacturing line subject to the standard. After the initial performance test, if an owner or operator wants to use a resin with a

higher free-formaldehyde content or change the binder formulation, another performance test must be conducted to verify compliance. Following the performance test, the owner or operator would maintain records of the free-formaldehyde content of each incoming resin lot, the formulation of each binder batch, and daily product LOI and product density. If resin free-formaldehyde content exceeds the performance test levels, the owner or operator would be in violation of the standard. Under the proposed NESHAP, the binder formulation must not deviate from the formulation specifications used during the performance test.

If the owner or operator of an RS or an FA manufacturing line plans to use forming process modifications to comply with the proposed standard, the operations, maintenance, and monitoring plan must specify the process parameters (e.g., LOI, binder solids, and/or binder application rate) to be monitored and their correlation with formaldehyde emissions, the monitoring schedule, and recordkeeping procedures for documenting compliance, in addition to procedures for the proper operation and maintenance of the process modifications. The owner or operator would monitor forming process parameters by adhering to the procedures detailed in their operations, maintenance, and monitoring plan. Should the process parameter(s) deviate from the range established during the performance test, the owner or operator must inspect the process to determine the cause of the deviation and initiate corrective action within 1 hour of the deviation. If the process parameter(s) are outside the performance test range for more than 5 percent of total operating time during a 6-month reporting period, the owner or operator would implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.¹⁰ If the process parameter(s) are outside the range for more than 10 percent of total operating time in a 6-month reporting period, the owner or operator would be in violation of the standard.

If a wet scrubbing control device is used to control formaldehyde emissions from an RS or FA manufacturing line subject to the standard, the owner or operator must establish during the performance test the pressure drop across each scrubber, the scrubbing liquid flow rate to each scrubber, and the identity and feed rate of any chemical added to the scrubbing liquid. If the owner or operator plans to operate

⁷ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

⁸ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

⁹ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

¹⁰ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

the scrubber in such a way that the pressure drop, liquid flow rate, or chemical additive or chemical feed rate exceeds the range of values established during the performance tests, additional testing would be necessary to demonstrate compliance. Following the initial performance tests, an owner or operator who uses a wet scrubbing control device to control formaldehyde emissions from an RS or FA manufacturing line would record the pressure drop across each scrubber, the scrubbing liquid flow rate to each scrubber, and the identity and feed rate of any chemical added to the scrubbing liquid. The proposed monitoring provisions also specify that corrective action be taken if the range of acceptable values established during the initial performance test is exceeded. Deviation by any 3-hour average scrubber parameter outside the established range would cause the owner or operator to inspect the process to determine the cause of the deviation and to initiate corrective actions according to the procedures in the operations, maintenance, and monitoring plan. Failure to initiate corrective actions within 1 hour of the deviation would be considered noncompliance. If any scrubber parameter is outside the performance test range for more than 5 percent of the total operating time in a 6-month reporting period, the owner or operator would implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.¹¹ If any of the scrubber parameter values are outside the range for more than 10 percent of total operating time in a 6-month reporting period, the owner or operator would be in violation of the standard.

If an incinerator is used to comply with the applicable emission limits for manufacturing lines, the incinerator operating temperature would have to be continuously monitored and recorded using a device such as a thermocouple with a strip chart recorder or data logger. During the performance test, the owner or operator would continuously monitor the temperature and record the average temperature during each 1-hour test. The average of the three 1-hour test runs would be used to monitor compliance. Following the performance tests, the owner or operator would maintain the temperature so that any 3-hour average does not fall below the temperature established during the performance test. If the temperature falls below the average, the owner or operator would be considered out of

compliance. The operations, maintenance, and monitoring plan for an incinerator would include procedures to follow in the event of a temperature drop. Examples of procedures that might be included in the plan for incinerators include: (1) inspection of burner assemblies and pilot sensing devices for proper operation and cleaning; (2) adjusting primary and secondary chamber combustion air; (3) inspecting dampers, fans, blowers, and motors for proper operation, and (4) shutdown procedures.

Under the proposed NESHAP, the owner or operator would be allowed to change the control device or process parameter levels established during the initial performance tests. The owner or operator would be permitted to expand the range or increase the level of any add-on control device or process parameter level used to monitor compliance by performing additional emission testing to demonstrate that at the new levels, the affected source complies with the emission limits in §§ 63.1382, 63.1383, or 63.1384.

The EPA general provisions in 40 CFR part 63, subpart A, require each owner or operator to develop and implement a startup, shutdown, and malfunction plan. Under the proposed NESHAP, the plan would include procedures for routine and long-term maintenance of the control devices according to the manufacturer's instructions or recommendations.

The EPA believes that these monitoring provisions will provide sufficient information needed to determine compliance or operating problems at the source. At the same time, the provisions are not labor intensive, do not require expensive, complex equipment, and are not burdensome in terms of recordkeeping needs.

F. Selection of Test Methods

Under the proposed NESHAP, the owner or operator conducts a one-time performance (emissions) test to determine initial compliance with the emission limits for glass-melting furnaces and manufacturing lines. Under the proposed rule, PM serves as a surrogate for HAP metals and formaldehyde, a HAP, serves as a surrogate measure for all organic HAPs.

The owner or operator would measure PM emissions from the control device (baghouse or ESP) exhaust outlet for the furnace or from the furnace exhaust outlet where no controls are in place using EPA Method 5 in appendix A to 40 CFR part 60, "Determination of Particulate Emissions from Stationary

Sources," and § 63.1388 (Test methods and procedures) of the proposed rule. To prevent sulfate formation in the sampling apparatus, the method specifies that the probe and filter holder be maintained at a temperature no greater than 177±14 °C (350±25 °F). To determine emissions of formaldehyde from RS manufacturing lines, the owner or operator would measure emissions of formaldehyde at the exhaust outlets of the forming, curing, and cooling processes and sum the measurements to determine manufacturing line emissions. To measure formaldehyde emissions from FA manufacturing lines subject to this standard, emissions from the forming process and from curing would be measured and the results summed to determine manufacturing line emissions. Formaldehyde emissions may be measured using EPA Method 316, "Sampling and Analysis for Formaldehyde Emissions from Stationary Sources in the Mineral Wool and Wool Fiberglass Industries," with formaldehyde analyses by spectrophotometry using the modified pararosaniline method. Method 316 is being proposed concurrently with this proposed rule. Method 316 is a manual test method for the measurement of formaldehyde. The method was developed by the industry trade group, NAIMA. The method was validated at a mineral wool facility, which has been determined to be a similar source, according to the procedures in Test Method 301, 40 CFR part 63, appendix A. In Method 316, gaseous and particulate pollutants are withdrawn isokinetically from an emission source and are collected in high purity water. Formaldehyde present in the emissions is highly soluble in water. The water containing formaldehyde is then analyzed using the modified pararosaniline method. Formaldehyde in the sample reacts with acidic pararosaniline and sodium sulfite, forming a purple chromophore. The intensity of the purple color, measured spectrophotometrically, provides a measure of the formaldehyde concentration in the sample.

Formaldehyde emissions can also be measured using EPA Method 318, "Extractive FTIR Method for the Measurement of Emissions from the Mineral Wool and Wool Fiberglass Industries." The Fourier Transform Infrared (FTIR) spectrometry method is also being proposed today for addition to appendix A to 40 CFR part 63. The FTIR spectrometry method uses a multicomponent measurement system to quantify a wide variety of pollutants in one test. Method 318 is an extractive

¹¹ Proposed rule published in the August 13, 1996 Federal Register (61 FR 41991).

FTIR procedure and has been validated by the EPA according to Method 301 requirements. The Method 318 procedure involves removing a slipstream of stack gas and filling a sample cell with the stack gas sample, which is then analyzed by FTIR spectrometry.

Methods for determining the product LOI and the free formaldehyde content of resins are also contained in the proposed rule. The owner or operator also may use other alternative test methods subject to approval by the Administrator.

Using the results of each test run and information generated during the performance tests (i.e., average glass pull rate in tons per hour for each test run), the owner or operator would then use the equations and procedures in the rule to convert the emission rate of PM and formaldehyde into the units of the standard.

G. Solicitation of Comments

The EPA seeks full public participation in arriving at its final decisions and encourages comments on all aspects of this proposal from all interested parties. Full supporting data and detailed analyses should be submitted with comments to allow EPA to make maximum use of the comments. All comments should be directed to the Air and Radiation Docket and Information Center, Docket No. A-95-24 (see **ADDRESSES**). Comments on this notice must be submitted on or before the date specified in **DATES**.

Commenters wishing to submit proprietary information for consideration should clearly distinguish such information from other comments and clearly label it "Confidential Business Information." Submissions containing such proprietary information should be sent directly to the following address, and not to the public docket, to ensure that proprietary information is not inadvertently placed in the docket: Attention: Mr. William Neuffer, c/o Ms. Melva Toomer, U.S. EPA Confidential Business Information Manager, OAQPS/MD-13; Research Triangle Park, North Carolina 27711. Information covered by such a claim of confidentiality will be disclosed by the EPA only to the extent allowed and by the procedures set forth in 40 CFR part 2. If no claim of confidentiality accompanies a submission when it is received by the EPA, the submission may be made available to the public without further notice to the commenter.

VI. Administrative Requirements

A. Docket

The docket is an organized and complete file of all the information considered by 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, except for certain interagency materials, will serve as the record for judicial review. [See section 307(d)(7)(A) of the Act.]

B. Public Hearing

A public hearing will be held, if requested, to discuss the proposed standards in accordance with section 307(d)(5) of the Act. If a public hearing is requested and held, EPA will ask clarifying questions during the oral presentation but will not respond to the presentations or comments. To provide an opportunity for all who may wish to speak, oral presentations will be limited to 15 minutes each. Any member of the public may file a written statement (see **DATES** and **ADDRESSES**). Written statements and supporting information will be considered with equivalent weight as any oral statement and supporting information subsequently presented at a public hearing, if held.

C. Executive Order 12866

Under Executive Order 12866 (58 FR 51735, October 4, 1993), EPA must determine whether the regulatory action is "significant" and therefore subject to review by the Office of Management and Budget (OMB) 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 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 obligation 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 a "significant regulatory action" within the meaning of Executive Order 12866, thus OMB review of the proposed regulation is not required. However, an economic impact analysis of the proposed NESHAP was prepared and is available in the docket.

D. Enhancing the Intergovernmental Partnership Under Executive Order 12875

In compliance with Executive Order 12875, we have involved State regulatory experts in the development of this proposed rule. No tribal governments are believed to be affected by this proposed rule. State and local governments are not directly impacted by the rule, i.e., they are not required to purchase control systems to meet the requirements of the rule. However, they will be required to implement the rule, e.g., incorporate the rule into permits and enforce the rule. They will collect permit fees that will be used to offset the resources burden of implementing the rule. Comments have been solicited from States and have been carefully considered in the rule development process. In addition, all States are encouraged to comment on this proposed rule during the public comment period, and the EPA intends to fully consider these comments in the development of the final rule.

E. Unfunded Mandates Reform Act

Section 202 of the Unfunded Mandates Reform Act of 1995 ("Unfunded Mandates Act"), signed into law on March 22, 1995 (109 Stat. 48), 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 aggregate, or by the private sector, of \$100 million or more 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.

Under section 205 of the Unfunded Mandates Act, the Agency must identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a budgetary impact statement must be prepared. The Agency must select from those alternatives the least costly, most cost-effective, or least burdensome alternative for State, local, and tribal governments and the private sector that

achieves the objectives of the rule, unless the Agency explains why this alternative is not selected or unless the selection of this alternative is inconsistent with law.

This rule is based partially on pollution prevention alternatives and has been applied on a manufacturing line basis. Therefore, it is the least costly and burdensome approach for industry since the purchase of add-on control devices will be avoided by most of the industry. The total nationwide capital cost for the standard is estimated at \$19.5 million; annual nationwide cost is estimated at \$6.3 million/yr. Because this proposed rule, if promulgated, is estimated to result in the expenditure by State and local governments, in aggregate, or by the private sector of less than \$100 million in any one year, the Agency has not prepared a budgetary impact statement. Because small governments will not be 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 action.

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 businesses, small not-for-profit enterprises, and small governmental jurisdictions. This proposed rule would not have a significant impact on a substantial number of small entities because no company that owns sources in the source category meets the criteria for small business. Companies in the wool fiberglass manufacturing industry are part of SIC 3296. Companies in SIC 3296 are classified as small by the U.S. Small Business Administration if the company has fewer than 750 employees. None of the firms in the industry have fewer than 750 employees and thus, are not small businesses by this criterion. Therefore, I certify that this action will not have a significant economic impact on a substantial number of small entities.

G. Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to OMB under the requirements of the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* An Information Collection Request (ICR) document has been

prepared by EPA (ICR No. 1795.01), and a copy may be obtained from Sandy Farmer, OPPE Regulatory Division, U.S. Environmental Protection Agency (2137), 401 M Street SW, Washington, DC 20460, or by calling (202) 260-2740.

The proposed information requirements include the notification, recordkeeping, and reporting requirements of the NESHAP general provisions, authorized under section 114 of the Act, which are mandatory for all owners or operators subject to national emission standards. All information submitted to EPA for which a claim of confidentiality is made is safeguarded according to Agency policies in 40 CFR part 2, subpart B. The proposed rule does not require any notifications or reports beyond those required by the general provisions. Proposed subpart NNN does require additional records of specific information needed to determine compliance with the rule. These include records of: (1) Any bag leak detection system alarm, including the date and time, with a brief explanation of the cause of the alarm and the corrective action taken; (2) ESP parameter values, such as secondary voltage for each electrical field, including any deviation outside the range established during the performance test and a brief explanation of the cause of the deviation and the corrective action taken; (3) uncontrolled furnace operating parameters, such as air temperature above the glass melt of cold top electric furnaces, including any exceedances of the established parameter values and a brief explanation of the cause and the corrective action taken; (4) the free-formaldehyde content of the resin being used; (5) the formulation of the binder being used; (6) the LOI and density for each bonded product manufactured on an RS or FA manufacturing line subject to the proposed NESHAP; (7) forming process modification parameters, including any period when the parameter levels are inconsistent with levels established during the performance test with a brief explanation of the cause and corrective actions taken; (8) pressure drop, liquid flow rate, and information on chemical additives to the scrubbing liquid including any period when the levels established during the performance tests are exceeded and a brief explanation of the cause and the corrective action taken; and (9) incinerator operating temperature, including any period when the temperature falls below the level established during the performance test, with a brief explanation of the cause of the deviation and the corrective action

taken. Each of these information requirements is needed to determine compliance with the standard.

The annual public reporting and recordkeeping burden for this collection is estimated at 17,800 labor hours per year at an annual cost of \$571,000. This estimate includes a one-time performance test and report (with repeat tests where needed); one-time preparation of a startup, shutdown, and malfunction plan with semiannual reports of any event in which the procedures in the plan were not followed; semiannual excess emissions reports; notifications; and recordkeeping. The annualized capital cost associated with monitoring requirements is estimated at \$41,000. The operation and maintenance cost is estimated at \$3,000/yr.

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 purpose of collecting, validating, verifying, processing, maintaining, disclosing, and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to respond to a collection of information; search existing 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, OPPE Regulatory Information Division; U.S. Environmental Protection Agency (2137), 401 M Street SW, Washington, DC 20460, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, NW, Washington, DC 20503, marked "Attention: Desk Office for EPA." Include the ICR number in any correspondence. Because OMB is required to make a decision concerning the ICR between 30 and 60 days after March 31, 1997, a comment to OMB is most likely to have its full effect if OMB

receives it by April 30, 1997. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

H. Clean Air Act

In accordance with section 117 of the Act, publication of this proposal was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies. This regulation will be reviewed 8 years from the date of promulgation. This review will include an assessment of such factors as evaluation of the residual health risks, any overlap with other programs, the existence of alternative methods, enforceability, improvements in emission control technology and health data, and the recordkeeping and reporting requirements.

I. Pollution Prevention Act

The Pollution Prevention Act of 1990 establishes that pollution should be prevented or reduced at the source whenever feasible. The emission standards for RS and FA manufacturing lines subject to the standard are formulated as line standards, i.e., the sum of the individual forming, curing, and cooling MACT floor emission levels for RS manufacturing lines and forming and curing MACT floor emission levels for certain FA manufacturing lines. By formulating the standard as a line standard, tradeoffs are allowed for existing facilities that will accomplish the same environmental results at lower costs and will encourage process modifications and pollution prevention alternatives. According to the industry, new RS manufacturing lines may be able to meet the line standard without the use of costly incinerators with their energy and other environmental impacts, such as increased nitrogen oxides (NO_x) and sulfur oxides (SO_x) emissions, by incorporating pollution prevention measures, such as binder reformulation and improved binder application efficiency. Pollution prevention alternatives will also increase binder utilization efficiency and reduce production costs for industry. In selecting the format of the emission standard for emissions from manufacturing lines, the EPA considered various alternatives such as setting separate emission limits for each process, i.e., forming, curing, and cooling. A line standard gives the industry greater flexibility in complying with the proposed emission limits and is the least costly because industry can avoid the capital and annual operating and maintenance costs associated with the purchase of add-on control

equipment by using pollution prevention measures.

List of Subjects in 40 CFR Part 63

Environmental protection, Air pollution control, Hazardous substances, Reporting and recordkeeping requirements, Wool fiberglass manufacturing.

Dated: February 21, 1997.

Carol M. Browner,
Administrator.

For the reasons set out in the preamble, part 63 of title 40, chapter I, of the Code of Federal Regulations is proposed to be amended as follows:

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

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

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

2. Part 63 is amended by adding subpart NNN to read as follows:

Subpart NNN—National Emission Standards for Hazardous Air Pollutants for Wool Fiberglass Manufacturing

Sec.

- 63.1380 Applicability.
- 63.1381 Definitions.
- 63.1382 Emission standards for glass-melting furnaces.
- 63.1383 Emission standards for rotary spin manufacturing lines.
- 63.1384 Emission standard for flame attenuation manufacturing lines.
- 63.1385 Compliance dates.
- 63.1386 Monitoring requirements.
- 63.1387 Performance test requirements.
- 63.1388 Test methods and procedures.
- 63.1389 Notification, recordkeeping, and reporting requirements.
- 63.1390 Delegation of authority.
- 63.1391 63.1399 [Reserved].

Table 1 to Subpart NNN—Applicability of general provisions (40 CFR part 63, subpart A) to subpart NNN.

Appendix A to Subpart NNN—Method for the determination of LOI

Appendix B to Subpart NNN—Free formaldehyde analysis of insulation resins by hydroxylamine hydrochloride

Appendix C to Subpart NNN—Method for the determination of product density

Subpart NNN—National Emission Standards for Hazardous Air Pollutants for Wool Fiberglass Manufacturing

§ 63.1380 Applicability.

(a) Except as provided in paragraphs (b) and (c) of this section, the requirements of this subpart apply to the owner or operator of each wool fiberglass manufacturing facility.

(b) The requirements of this subpart apply to emissions of hazardous air

pollutants (HAPs), as measured according to the methods and procedures in this subpart, emitted from the following sources at a wool fiberglass manufacturing facility subject to this subpart:

(1) Each new and existing glass-melting furnace located at a wool fiberglass manufacturing facility;

(2) Each new and existing rotary spin wool fiberglass manufacturing line producing a bonded wool fiberglass building insulation product; and

(3) Each new and existing flame attenuation wool fiberglass manufacturing line producing a bonded pipe product and each new flame attenuation wool fiberglass manufacturing line producing a bonded heavy-density product.

(c) The requirements of this subpart do not apply to the owner or operator of a wool fiberglass manufacturing facility that the owner or operator demonstrates, to the satisfaction of the Administrator, is not a major source as defined in § 63.2 of the general provisions.

(d) The provisions of 40 CFR Part 63, Subpart A—General Provisions that apply and those that do not apply to this subpart are specified in Table 1 of this subpart.

§ 63.1381 Definitions.

Terms used in this subpart are defined in the Clean Air Act, in § 63.2, or in this section as follows:

Bag leak detection system means systems that include, but are not limited to, devices using triboelectric, light scattering, and other effects to monitor relative or absolute particulate matter (PM) emissions.

Bonded means wool fiberglass to which a phenol-formaldehyde binder has been applied.

Building insulation means the bonded wool fiberglass insulation, having a loss on ignition of less than 8 percent and a density of less than 32 kilograms per cubic meter (kg/m³) (2 pounds per cubic foot [lb/ft³]), most frequently manufactured (as measured by hours of production times glass pull rate) during the preceding calendar year.

Flame attenuation means a process used to produce wool fiberglass where molten glass flows by gravity from melting furnaces, or pots, to form filaments that are drawn down and attenuated by passing in front of a high-velocity gas burner flame.

Glass-melting furnace means a unit comprising a refractory vessel in which raw materials are charged, melted at high temperature, refined, and conditioned to produce molten glass. The unit includes foundations,

superstructure and retaining walls, raw material charger systems, heat exchangers, melter cooling system, exhaust system, refractory brick work, fuel supply and electrical boosting equipment, integral control systems and instrumentation, and appendages for conditioning and distributing molten glass to forming processes. The forming apparatus, including flow channels, is not considered part of the *glass-melting furnace*.

Glass pull rate means the mass of molten glass used in the manufacture of wool fiberglass at a single manufacturing line in a specified time period.

HAP means those chemicals and their compounds that are included on the list of hazardous air pollutants in section 112(b) of the Clean Air Act.

Heavy-density product means bonded wool fiberglass insulation manufactured on a flame attenuation manufacturing line and having a loss on ignition of 11 to 25 percent and a density of 8 to 48 kg/m³ (0.5 to 3 lb/ft³).

Incinerator means an enclosed air pollution control device that uses controlled flame combustion to convert combustible materials to noncombustible gases.

Loss on ignition (LOI) means the percent decrease in weight of wool fiberglass after it has been ignited. The LOI is used to monitor the weight percent of binder in wool fiberglass.

Manufacturing line means the manufacturing equipment comprising any combination of a forming section, where molten glass is fiberized and a fiberglass mat is formed; a curing section, where binder resin in the mat is thermally set; and a cooling section, where the mat is cooled.

Pipe product means bonded wool fiberglass insulation manufactured on a flame attenuation manufacturing line and having a loss on ignition of 8 to 14 percent and a density of 48 to 96 kg/m³ (3 to 6 lb/ft³).

Rotary spin means a process used to produce wool fiberglass building insulation by forcing molten glass through numerous small orifices in the side wall of a spinner to form continuous glass fibers that are then broken into discrete lengths by high-velocity air flow. Any process used to produce bonded wool fiberglass building insulation by a process other than flame attenuation is considered rotary spin.

Wool fiberglass means a thermal, acoustical, or other insulation material composed of glass fibers made from glass produced or melted at the same facility where the manufacturing line is located.

§ 63.1382 Emission standards for glass-melting furnaces.

On or after the date the initial performance test is completed or required to be completed under § 63.7, whichever date is earlier, the owner or operator shall not discharge or cause to be discharged into the atmosphere in excess of 0.25 kilogram (kg) of particulate matter (PM) per megagram (Mg) (0.5 pound [lb] of PM per ton) of glass pulled for each new or existing glass-melting furnace.

§ 63.1383 Emission standards for rotary spin manufacturing lines.

On or after the date the initial performance test is completed or required to be completed under § 63.7, whichever date is earlier, the owner or operator shall not discharge or cause to be discharged into the atmosphere in excess of:

(a) 0.6 kg of formaldehyde per megagram (1.2 lb of formaldehyde per ton) of glass pulled for each existing rotary spin manufacturing line; and

(b) 0.4 kg of formaldehyde per megagram (0.8 lb of formaldehyde per ton) of glass pulled for each new rotary spin manufacturing line.

§ 63.1384 Emission standards for flame attenuation manufacturing lines.

On or after the date the initial performance test is completed or required to be completed under § 63.7, whichever date is earlier, the owner or operator shall not discharge or cause to be discharged into the atmosphere in excess of:

(a) 3.9 kg of formaldehyde per megagram (7.8 lb of formaldehyde per ton) of glass pulled for each new flame attenuation manufacturing line that produces heavy-density wool fiberglass; and

(b) 3.4 kg of formaldehyde per megagram (6.8 lb of formaldehyde per ton) of glass pulled from each existing or new flame attenuation manufacturing line that produces pipe product wool fiberglass.

§ 63.1385 Compliance dates.

(a) *Compliance dates.* The owner or operator subject to the provisions of this subpart shall demonstrate compliance with the requirements of this subpart by no later than:

(1) (Date 3 years after effective date of the final rule) for an existing glass-melting furnace, rotary spin manufacturing line, or flame attenuation manufacturing line; or

(2) Upon startup for a new glass-melting furnace, rotary spin manufacturing line, or flame attenuation manufacturing line.

(b) *Compliance extension.* The owner or operator may request from the Administrator, or the applicable regulatory authority in a State with an approved permit program, an extension of the compliance date for the emission standards for one additional year if needed to install add-on controls or process modifications. The owner or operator shall submit a request for an extension according to the procedures in § 63.6(i)(3) of the general provisions.

§ 63.1386 Monitoring requirements.

(a) The owner or operator of each wool fiberglass manufacturing facility shall prepare for each glass-melting furnace, RS manufacturing line, and FA manufacturing line subject to the provisions of this subpart, a written operations, maintenance, and monitoring plan. The plan shall be submitted to the Administrator for review and approval as part of the application for a part 70 permit and shall include the following information:

(1) Procedures for the proper operation and maintenance of process modifications and add-on control devices used to meet the emission limits of §§ 63.1382, 63.1383, and 63.1384;

(2) Process parameters and add-on control device parameters to be monitored to determine compliance; and

(3) Corrective actions to be taken when process parameters or add-on control device parameters deviate from the levels established during initial performance testing.

(b) Where a baghouse is used to control PM emissions from a glass-melting furnace, the owner or operator shall install, calibrate, maintain, and continuously operate a bag leak detection system.

(1) The bag leak detection system must be capable of detecting PM emissions at concentrations of 1.0 milligram per actual cubic meter (0.0004 grains per actual cubic foot) and greater.

(2) The bag leak detection system sensor must provide output of relative or absolute PM emissions.

(3) The bag leak detection system must be equipped with an alarm system that will sound when an increase in PM emissions over a preset level is detected.

(4) For positive pressure fabric filter systems, a bag leak detection system must be installed in each baghouse compartment or cell. If a negative pressure or induced air baghouse is used, the bag leak detection system must be installed downstream of the baghouse. Where multiple bag leak detection systems are required (for either type of baghouse), the system

instrumentation and alarm may be shared among the monitors.

(5) The bag leak detection system shall be installed, operated, calibrated, and maintained in a manner consistent with available guidance from the U.S. Environmental Protection Agency or, in the absence of such guidance, the manufacturer's written specifications and recommendations.

(6) Calibration of the system shall, at a minimum, consist of establishing the baseline output by adjusting the range and the averaging period of the device and establishing the alarm setpoints and the alarm delay time. Calibration of the system shall be done during the initial performance test.

(7) The owner or operator shall not adjust the range, averaging period, alarm setpoints, or alarm delay time after the initial performance test without written approval from the Administrator.

(8) Following the performance test, if the alarm for the bag leak detection system is triggered, the owner or operator shall inspect the control device to determine the cause of the deviation and initiate within 1 hour of the alarm the corrective actions specified in the procedures in the operations, maintenance, and monitoring plan.

(9) If the alarm is sounded for more than 5 percent of the total operating time in a 6-month reporting period, the owner or operator must implement a Quality Improvement Plan (QIP) consistent with subpart D of the draft approach to compliance assurance monitoring.¹

(c)(1) Where an electrostatic precipitator (ESP) is used to control PM emissions from a glass-melting furnace, the owner or operator shall include in the ESP operations, maintenance, and monitoring plan the following information:

(i) ESP operating parameter(s), such as secondary voltage of each electrical field, to be monitored and the procedures to be followed during the performance test to establish the range of values that will be used to identify any operational problems;

(ii) A schedule for monitoring the ESP operating parameter(s);

(iii) Recordkeeping procedures, consistent with § 63.1389, to show that the ESP operating parameter(s) is within the range established during the performance test; and

(iv) Procedures for the proper operation and maintenance of the ESP.

(2) Following the performance test, if any 3-hour average value for the ESP monitoring parameter(s) deviates from

the range established during the performance test, the owner or operator shall inspect the control device to determine the cause of the deviation and initiate within 1 hour of the deviation the corrective actions necessary to return the ESP parameter(s) to the levels established during the performance test according to the procedures in the operations, maintenance, and monitoring plan.

(3) If the monitored ESP parameter is outside the level established during the performance test more than 5 percent of the total operating time in a 6-month reporting period, the owner or operator must implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.²

(4) If the monitored ESP parameter is outside the level established during the performance test more than 10 percent of the total operating time in a 6-month reporting period, the owner or operator is in violation of the standard.

(d)(1) For a glass-melting furnace, including a cold top electric furnace, where no add-on controls are used to control PM emissions, the owner or operator shall include in the operations, maintenance, and monitoring plan the following information:

(i) The operating parameter(s), such as the air temperature above the glass melt, to be monitored and the procedures to be followed during the performance test to establish the range of values that will be used to identify any operational problems;

(ii) A schedule for monitoring the operating parameter(s) of the glass-melting furnace;

(iii) Recordkeeping procedures, consistent with § 63.1389, to show that the glass-melting furnace parameter(s) is within the range established during the performance test; and

(iv) Procedures for the proper operation and maintenance of the glass-melting furnace.

(2) Following the performance test, if any 3-hour average value for the parameter used to monitor uncontrolled glass-melting furnaces deviates from the range established during the performance test, the owner or operator shall inspect the glass-melting furnace to determine the cause of the deviation and initiate within 1 hour of the deviation the corrective actions necessary to return the process parameter(s) to the levels established during the performance test according to the procedures in the operations, maintenance, and monitoring plan.

(3) If the monitored parameter is outside the level established during the performance test more than 5 percent of the total operating time in a 6-month reporting period, the owner or operator must implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.³

(4) If the monitored parameter is outside the level established during the performance test more than 10 percent of the total operating time in a 6-month reporting period, the owner or operator is in violation of the standard.

(e)(1) The owners or operators of existing glass-melting furnaces shall continuously monitor and record the glass pull rate except that for glass-melting furnaces that are not equipped with continuous monitors, the glass pull rate shall be monitored and recorded once per day.

(2) On all new glass-melting furnaces, the owner or operator shall install, calibrate, and maintain monitors that continuously record the glass pull rate.

(3) Following the performance test, if the glass pull rate exceeds the average glass pull rate established during the performance test by greater than 20 percent, the owner or operator shall inspect the glass-melting furnace to determine the cause of the exceedance and initiate within 1 hour of the exceedance the corrective actions necessary to return the glass pull rate to the level established during the performance test according to the procedures in the operations, maintenance, and monitoring plan.

(4) If the glass pull rate exceeds by more than 20 percent the level established during the performance test for more than 5 percent of the total operating time in a 6-month reporting period, the owner or operator must implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.⁴

(5) If the glass pull rate exceeds by 20 percent the level established during the performance test for more than 10 percent of the total operating time in a 6-month reporting period, the owner or operator is in violation of the standard.

(f)(1) The owner or operator who uses an incinerator to control formaldehyde emissions from forming or curing shall install, calibrate, maintain, and operate a monitoring device that continuously measures and records the operating temperature in the firebox of each incinerator.

(2) Following the performance test, if any 3-hour average operating

¹ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

² Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

³ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

⁴ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

temperature of the incinerator falls below the average established during the performance test, the owner or operator is considered out of compliance.

(g)(1) The owner or operator of each rotary spin manufacturing line and flame attenuation manufacturing line subject to the provisions of this subpart shall monitor and record the following information:

(i) The free-formaldehyde content of each resin lot;

(ii) The formulation of each batch of binder used; and

(iii) At least once per day, the LOI and density of each bonded wool fiberglass product manufactured.

(2) Following the performance test, if the free-formaldehyde content of the resin exceeds the levels established during the performance test or the binder formulation varies from the binder formulation specification established during the performance test, the owner or operator is in violation of the standard.

(h)(1) The owner or operator of each rotary spin manufacturing line and flame attenuation manufacturing line subject to the provisions of this subpart who uses process modifications to comply with the standards in §§ 63.1383 and 63.1384 shall include as part of their operations, maintenance, and monitoring plan the following information:

(i) Procedures for the proper operation and maintenance of the process;

(ii) Process parameters to be monitored to demonstrate compliance with the applicable emission standards in §§ 63.1383 and 63.1384. Examples of process parameters include LOI, binder solids content, and binder application rate;

(iii) Correlation(s) between process parameter(s) to be monitored and formaldehyde emissions;

(iv) A schedule for monitoring the process parameters; and

(v) Recordkeeping procedures, consistent with § 63.1389, to show that the process parameters values established during the performance test are not exceeded.

(2) Following the performance test, if the process parameter levels exceed the levels established during the performance test, the owner or operator shall inspect the process to determine the cause of the deviation and initiate within 1 hour of the deviation the corrective actions necessary to return the process parameter(s) to the levels established during the performance test according to the procedures in the operations, maintenance, and monitoring plan.

(3) If the process parameter is outside the level established during the performance test more than 5 percent of the total operating time in a 6-month reporting period, the owner or operator must implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.⁵

(4) If the process parameter is outside the level established during the performance test more than 10 percent of the total operating time in a 6-month reporting period, the owner or operator is in violation of the standard.

(i)(1) The owner or operator of each rotary spin manufacturing line and flame attenuation manufacturing line subject to the provisions of this subpart who uses a wet scrubbing control device to comply with the emission standards in §§ 63.1383 and 63.1384 shall install, calibrate, maintain, and operate monitoring devices that continuously monitor and record the gas pressure drop across each scrubber and scrubbing liquid flow rate to each scrubber. The pressure drop monitor is to be certified by its manufacturer to be accurate within ± 250 pascals (± 1 inch water gauge) over its operating range, and the flow rate monitor is to be certified by its manufacturer to be accurate within ± 5 percent over its operating range. The owner or operator shall also continuously monitor and record the feed rate of any chemical(s) added to the scrubbing liquid.

(2) Following the performance test, if any 3-hour average of the scrubber pressure drop, liquid flow rate, or chemical additive to the scrubber exceeds the levels established during the performance tests, the owner or operator shall inspect the control device to determine the cause of the exceedance and initiate within 1 hour of the exceedance the corrective actions necessary to return the scrubber parameters to the levels established during the performance test according to the procedures in the scrubber operations, maintenance, and monitoring plan.

(3) If a scrubber parameter is outside the level established during the performance test more than 5 percent of the total operating time in a 6-month reporting period, the owner or operator must implement a QIP consistent with subpart D of the draft approach to compliance assurance monitoring.⁶

(4) If a scrubber parameter is outside the level established during the performance test more than 10 percent

of the total operating time in a 6-month reporting period, the owner or operator is in violation of the standard.

(j) For all control device and process operating parameters measured during the initial performance test, the owners or operators of glass-melting furnaces, rotary spin manufacturing lines or flame attenuation manufacturing lines subject to this subpart may change the ranges established during the initial performance test if additional performance testing is conducted to verify that, at the new control device or process parameter levels, they comply with the emission standards in §§ 63.1382, 63.1383, and 63.1384.

§ 63.1387 Performance test requirements.

(a) The owner or operator subject to the provisions of this subpart shall conduct a performance test to demonstrate compliance with the applicable emission standards in §§ 63.1382, 63.1383, and 63.1384. The owner or operator shall conduct the performance test, according to the procedures in the general provisions (40 CFR part 63, subpart A) and in this section.

(1) All monitoring systems and equipment must be installed, operational, and properly calibrated prior to the performance test.

(2) The owner or operator shall monitor and record the glass pull rate and determine the average of the recorded measurements for each test run.

(3) The owner or operator shall conduct a performance test for each existing and new glass-melting furnace.

(4) The owner or operator shall conduct a performance test for each new and existing rotary spin manufacturing line producing building insulation.

(5) The owner or operator shall conduct a performance test for each new flame attenuation manufacturing line producing a heavy-density product or a pipe product and each existing flame attenuation manufacturing line producing a pipe product.

(6) During the performance test, the owner or operator of a glass-melting furnace controlled by an ESP shall monitor and record the ESP parameter level(s), as specified in the operation, maintenance, and monitoring plan required in § 63.1386, which will be used to demonstrate compliance after the initial performance test. If the owner or operator plans a change in the ESP parameter levels from the levels established during the initial performance test, another performance test is required.

(7) The owner or operator of each rotary spin manufacturing line and

⁵ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

⁶ Proposed rule published in the August 13, 1996 **Federal Register** (61 FR 41991).

flame attenuation manufacturing line regulated by this subpart shall conduct performance tests using the resin with the highest free-formaldehyde content. During the performance test of each rotary spin manufacturing line and flame attenuation manufacturing line regulated by this subpart, the owner or operator shall monitor and record the free-formaldehyde content of the resin, the binder formulation used, and the product LOI. If the owner or operator of a rotary spin manufacturing line or a flame attenuation manufacturing line subject to this subpart plans to use a resin with a higher free-formaldehyde content or a different binder formulation than that recorded during the initial performance test, another performance test is required.

(8) With prior approval from the Administrator, an owner or operator of a rotary spin or flame attenuation manufacturing line regulated by this subpart may conduct short-term experimental production runs using binder formulations or other process modifications where the free-formaldehyde content or other process parameter values would be outside those established during performance tests without first conducting performance tests. An application to perform an experimental short-term production run shall include the following information:

- (i) The purpose of the experimental run;
- (ii) The affected line;
- (iii) How the established process parameters will deviate from previously approved levels;
- (iv) The duration of the test run;
- (v) The date and time of the test run; and
- (vi) A description of any emission testing to be performed during the test.

(9) During the performance test, the owner or operator shall continuously record the operating temperature of each incinerator and record the average of each 1-hour test; the average of the three 1-hour tests shall be used to monitor compliance.

(10) During the performance test, the owner or operator of a rotary spin manufacturing line or flame attenuation manufacturing line who plans to use process modifications to comply with the emission standards in §§ 63.1383 and 63.1384 shall monitor and record the process parameter level(s), as specified in the operations, maintenance, and monitoring plan required in § 63.1386, which will be used to demonstrate compliance after the initial performance test. If the owner or operator plans a change in the process parameter levels from the levels

established during the initial performance test, another performance test is required.

(11) During the performance test, the owner or operator of a rotary spin manufacturing line or flame attenuation manufacturing line who plans to use a wet scrubbing control device to comply with the emission standards in §§ 63.1383 and 63.1384 shall continuously monitor and record the pressure drop across the scrubber, the scrubbing liquid flow rate, and addition of any chemical to the scrubber including the chemical feed rate to be used to determine compliance after the initial performance test.

(b) To determine compliance with the PM emission standard for glass-melting furnaces, use the following equation:

$$E = \frac{C \times Q \times K_1}{P} \quad (\text{Eq. 1})$$

where:

E = Emission rate of PM, kg/Mg (lb/ton) of glass pulled;

C = Concentration of PM, g/dscm (gr/dscf);

Q = Volumetric flow rate of exhaust gases, dscm/h (dscf/h);

K₁ = Conversion factor, 1 kg/1,000 g (1 lb/7,000 gr); and

P = Average glass pull rate, Mg/h (tons/h).

(c) To determine compliance with the emission standard for formaldehyde for rotary spin manufacturing lines and flame attenuation forming processes, use the following equation:

$$E = \frac{C \times MW \times Q \times K_1 \times K_2}{K_3 \times P \times 10^6} \quad (\text{Eq. 2})$$

where:

E = Emission rate of formaldehyde, kg/Mg (lb/ton) of glass pulled;

C = Measured volume fraction of formaldehyde, ppm;

MW = Molecular weight of formaldehyde, 30.03 g/g-mol;

Q = Volumetric flow rate of exhaust gases, dscm/h (dscf/h);

K₁ = Conversion factor, 1 kg/1,000 g (1 lb/453.6 g);

K₂ = Conversion factor, 1,000 L/m³ (28.3 L/ft³);

K₃ = Conversion factor, 24.45 L/g-mol; and

P = Average glass pull rate, Mg/h (tons/h).

§ 63.1388 Test methods and procedures.

(a) The owner or operator shall use the following methods to determine compliance with the applicable emission standards:

- (1) Method 1 (40 CFR part 60, appendix A) for the selection of the

sampling port location and number of sampling ports;

- (2) Method 2 (40 CFR part 60, appendix A) for volumetric flow rate;

- (3) Method 3 or 3A (40 CFR part 60, appendix A) for O₂ and CO₂ for diluent measurements needed to correct the concentration measurements to a standard basis;

- (4) Method 4 (40 CFR part 60, appendix A) for moisture content of the stack gas;

- (5) Method 5 (40 CFR part 60, appendix A) for the concentration of PM. Each run shall consist of a minimum run time of 2 hours and a minimum sample volume of 60 dry standard cubic feet (dscf). The probe and filter holder heating system may be set to provide a gas temperature no greater than 177 ± 14 °C (350 ± 25 °F);

- (6) Method 316 (appendix A of this part) for the concentration of formaldehyde. Each run shall consist of a minimum run time of 1 hour;

- (7) Method 318 (appendix A of this part) for the concentration of formaldehyde;

- (8) Method contained in appendix A of this subpart for the determination of product LOI;

- (9) Method contained in appendix B of this subpart for the determination of the free-formaldehyde content of resin;

- (10) Method contained in appendix C of this subpart for the determination of product density;

- (11) An alternative method, subject to approval by the Administrator.

(b) Each performance test shall consist of 3 runs. The owner or operator shall use the average of the three runs in the applicable equation for determining compliance.

§ 63.1389 Notification, recordkeeping, and reporting requirements.

(a) *Notifications.* As required by § 63.9 (b) through (d), the owner or operator shall submit the following written initial notifications to the Administrator:

- (1) Notification for an area source that subsequently increases its emissions such that the source is a major source subject to the standard;

- (2) Notification that a source is subject to the standard, where the initial startup is before the effective date of the standard;

- (3) Notification that a source is subject to the standard, where the source is new or has been reconstructed, the initial startup is after the effective date of the standard, and for which an application for approval of construction or reconstruction is not required;

- (4) Notification of intention to construct a new major source or

reconstruct a major source; of the date construction or reconstruction commenced; of the anticipated date of startup; of the actual date of startup, where the initial startup of a new or reconstructed source occurs after the effective date of the standard, and for which an application for approval or construction or reconstruction is required (See § 63.9(b)(4) and (5));

(5) Notification of special compliance obligations;

(6) Notification of performance test; and

(7) Notification of compliance status.

(b) *Performance test report.* As required by § 63.10(d)(2), the owner or operator shall report the results of the initial performance test as part of the notification of compliance status required in paragraph (a)(7) of this section.

(c) *Startup, shutdown, and malfunction plan and reports.* (1) The owner or operator shall develop and implement a written plan as described in § 63.6(e)(3) of the general provisions that contains specific procedures to be followed for operating the source and maintaining the source during periods of startup, shutdown, and malfunction and a program of corrective action for malfunctioning process modifications and control systems used to comply with the standard. In addition to the information required in § 63.6(e)(3), the plan shall include:

(i) Procedures to determine and record the cause of the malfunction and the time the malfunction began and ended;

(ii) Corrective actions to be taken in the event of a malfunction of a control device or process modification, including procedures for recording the actions taken to correct the malfunction or minimize emissions; and

(iii) A maintenance schedule for each control device and process modification that is consistent with the manufacturer's instructions and recommendations for routine and long-term maintenance.

(2) The owner or operator shall also keep records of each event as required by § 63.10(b) of the general provisions

and record and report if an action taken during a startup, shutdown, or malfunction is not consistent with the procedures in the plan as described in § 63.10(e)(3)(iv) of the general provisions.

(d) *Excess emissions report.* As required by § 63.10(e)(3)(v) of the general provisions, the owner or operator shall report semiannually if measured emissions are in excess of the applicable standard or a monitored parameter is exceeded. The report shall contain the information specified in § 63.10(c) of the general provisions. When no exceedances have occurred, the owner or operator shall submit a report stating that no excess emissions occurred during the reporting period.

(e) *Recordkeeping.* (1) As required by § 63.10(b) of the general provisions, the owner or operator shall maintain files of all information (including all reports and notifications) required by the general provisions and this subpart:

(i) The owner or operator must retain each record for at least 5 years following the date of each occurrence, measurement, maintenance, corrective action, report, or record. The most recent 2 years of records must be retained at the facility. The remaining 3 years of records may be retained off site;

(ii) The owner or operator may retain records on microfilm, on a computer, on computer disks, on magnetic tape, or on microfiche; and

(iii) The owner or operator may report required information on paper or on a labeled computer disk using commonly available and EPA-compatible computer software.

(2) In addition to the general records required by § 63.10(b)(2) of the general provisions, the owner or operator shall maintain records of the following information:

(i) Any bag leak detection system alarm, including the date and time, with a brief explanation of the cause of the alarm and the corrective action taken;

(ii) The ESP monitoring parameters including any deviation in the ESP monitoring parameters with a brief explanation of the cause of the deviation and the corrective action taken;

(iii) The monitoring parameter for uncontrolled glass-melting furnaces including any exceedances and a brief explanation of the cause of the exceedance and the corrective action taken;

(iv) The formulation of each binder batch on a rotary spin manufacturing line or flame attenuation manufacturing line subject to the provisions of this subpart and the free formaldehyde content of each resin lot;

(v) Forming process parameters as identified in the approved operations, maintenance, and monitoring plan where process modifications are used to comply with the applicable emission limits, including any period when the process parameter levels were inconsistent with the levels established during the performance test, with a brief explanation of the cause of the deviation and the corrective action taken;

(vi) Scrubber operating parameters where a scrubber is used to comply with the applicable formaldehyde emission limits, including any periods of exceedances with a brief explanation of the cause of the deviation and the corrective action taken;

(vii) Incinerator operating temperature, including any period when the temperature falls below the average temperature established during the performance test, with a brief explanation of the cause of the deviation and the corrective action taken; and

(viii) The LOI for each product manufactured on a rotary spin manufacturing line or flame attenuation manufacturing line subject to the provisions of this subpart.

§ 63.1390 Delegation of authority.

(a) In delegating implementation and enforcement authority to a State under section 112(d) of the Act, the authorities contained in paragraph (b) of this section shall be retained by the Administrator and not transferred to a State.

(b) Authorities which will not be delegated to States: § 63.1388(a)(11).

§§ 63.1391–63.1399 [Reserved]

TABLE 1 TO SUBPART NNN—APPLICABILITY OF GENERAL PROVISIONS

[40 CFR Part 63, Subpart A to Subpart NNN]

General provisions citation	Requirement	Applies to subpart NNN	Comment
63.1(a)(1)–(a)(4)	Applicability	Yes	
63.1(a)(5) .....	.....	No	[Reserved].
63.1(a)(6)–(a)(8) .....	.....	Yes	
63.1(a)(9) .....	.....	No	[Reserved].
63.1(a)(10)–(a)(14) .....	.....	Yes	
63.1(b)(1)–(b)(3)	Initial Applicability Determination	Yes	

TABLE 1 TO SUBPART NNN—APPLICABILITY OF GENERAL PROVISIONS—Continued
[40 CFR Part 63, Subpart A to Subpart NNN]

General provisions citation	Requirement	Applies to subpart NNN	Comment
63.1(c)(1)–(c)(2)	Applicability After Standard Established ...	Yes	
63.1(c)(3) .....	.....	No	[Reserved].
63.1(c)(4)–(c)(5) .....	.....	Yes	
63.1(d) .....	.....	No	[Reserved].
63.1(e)	Applicability of Permit Program	Yes	
63.2	Definitions	Yes	Additional definitions in § 63.1381.
63.3(a)–(c)	Units and Abbreviations	Yes	
63.4(a)(1)–(a)(3)	Prohibited Activities	Yes	
63.4(a)(4) .....	.....	No	[Reserved].
63.4(a)(5) .....	.....	Yes	
63.4(b)–(c) .....	.....	Yes	
63.5(a)(1)–(a)(2)	Construction/Reconstruction	Yes	
63.5(b)(1)	Existing, New, Reconstructed	Yes	
63.5(b)(2) .....	.....	No	[Reserved].
63.5(b)(3)–(b)(6) .....	.....	Yes	
63.5(c) .....	.....	No	[Reserved].
63.5(d)	Approval of Construction/Reconstruction ..	Yes	
63.5(e) .....	.....	Yes	
63.5(f) .....	.....	Yes	
63.6(a)	Compliance with Standards and Maintenance Requirements.	Yes	
63.6(b)(1)–(b)(5) .....	.....	Yes	
63.6(b)(6) .....	.....	No	[Reserved].
63.6(b)(7) .....	.....	Yes	
63.6(c)(1)	Compliance Date for Existing Sources	Yes	§ 63.1385 specifies compliance dates.
63.6(c)(2) .....	.....	Yes	
63.6(c)(3)–(c)(4) .....	.....	No	[Reserved].
63.6(c)(5) .....	.....	Yes	
63.6(d) .....	.....	No	[Reserved].
63.6(e)(1)–(e)(2)	Operation & Maintenance	Yes	§ 63.1386(a) specifies operations/ maintenance plan
63.6(e)(3)	Startup, Shutdown Malfunction Plan	Yes	
63.6(f)(1)–(f)(3)	Compliance with Nonopacity Emission Standards.	Yes	
63.6(g)(1)–(g)(3)	Alternative Nonopacity Standard	Yes	
63.6(h)	Opacity/VE Standards	No	Subpart NNN-no COMS, VE or opacity standards.
63.6(i)(1)–(i)(14)	Extension of Compliance	Yes	
63.6(i)(15) .....	.....	No	[Reserved].
63.6(i)(16) .....	.....	Yes	
63.6(j)	Exemption from Compliance	Yes	
63.7(a)	Performance Testing Requirements	Yes	§ 63.1387 has specific requirements.
63.7(b)	Notification	Yes	
63.7(c)	Quality Assurance Program/Test Plan	Yes	
63.7(d)	Performance Testing Facilities	Yes	
63.7(e)(1)–(e)(4)	Conduct of Performance Tests	Yes	
63.7(f)	Alternative Test Method	Yes	
63.7(g)	Data Analysis	Yes	
63.7(h)	Waiver of Performance Tests	Yes	
63.8(a)(1)–(a)(2)	Monitoring Requirements	Yes	
63.8(a)(3) .....	.....	No	[Reserved].
63.8(a)(4) .....	.....	Yes	
63.8(b)	Conduct of Monitoring	Yes	
63.8(c)	CMS Operation/Maintenance	Yes	
63.8(d)	Quality Control Program	Yes	
63.8(e)	Performance Evaluation for CMS	Yes	
63.8(f)	Alternative Monitoring Method	Yes	
63.8(g)	Reduction of Monitoring Data	Yes	
63.9(a)	Notification Requirements	Yes	
63.9(b)	Initial Notifications	Yes	
63.9(c)	Request for Compliance Extension	Yes	
63.9(d)	New Source Notification for Special Compliance Requirements.	Yes	
63.9(e)	Notification of Performance Test	Yes	
63.9(f)	Notification of VE/Opacity Test	No	Opacity/VE tests not required.
63.9(g)	Additional CMS Notifications	Yes	
63.9(h)(1)–(h)(3)	Notification of Compliance Status	Yes	
63.9(h)(4) .....	.....	No	[Reserved].
63.9(h)(5)–(h)(6) .....	.....	Yes	

TABLE 1 TO SUBPART NNN—APPLICABILITY OF GENERAL PROVISIONS—Continued
[40 CFR Part 63, Subpart A to Subpart NNN]

General provisions citation	Requirement	Applies to subpart NNN	Comment
63.9(i)	Adjustment of Deadlines	Yes	
63.9(j)	Change in Previous Information	Yes	
63.10(a)	Recordkeeping/Reporting	Yes	
63.10(b)	General Requirements	Yes	
63.10(c)(1)	Additional CMS Recordkeeping	Yes	
63.10(c)(2)–(c)(4) .....	.....	No	[Reserved].
63.10(c)(5)–(c)(8) .....	.....	Yes	
63.10(c)(9) .....	.....	No	[Reserved].
63.10(c)(10)–(15) .....	.....	Yes	
63.10(d)(1)	General Reporting Requirements	Yes	
63.10(d)(2)	Performance Test Results	Yes	
63.10(d)(3)	Opacity or VE Observations	No	No limits for VE/opacity.
63.10(d)(4)	Progress Reports	Yes	
63.10(d)(5)	Startup, Shutdown, Malfunction Reports ...	Yes	
63.10(e)(1)–(e)(3)	Additional CMS Reports	Yes	
63.10(e)(4)	Reporting COM Data	No	COM not required
63.10(f)	Waiver of Recordkeeping/Reporting	Yes	
63.11(a)	Control Device Requirements	Yes	
63.11(b)	Flares	No	Flares not applicable.
63.12	State Authority and Delegations	Yes	
63.13	State/Regional Addresses	Yes	
63.14	Incorporation by Reference	No.	
63.15	Availability of Information	Yes	

Appendix A to Subpart NNN—Method for the Determination of LOI

1. Purpose.

The purpose of this test is to determine the LOI of cured blanket insulation. The method is applicable to all cured board and blanket products.

2. Equipment.

2.1 Scale sensitive to 0.1 gram.

2.2 Furnace designed to heat to at least 540 °C (1,000 °F) and controllable to ±10 °C (50 °F).

2.3 Wire tray for holding specimen while in furnace.

3. Procedure.

3.1 Cut a strip along the entire width of the product that will weigh at least 10.0 grams. Sample should be free of dirt or foreign matter. (Note: Remove all facing from sample.)

3.2 Cut the sample into pieces approximately 12 inches long, weigh to the nearest 0.1 gram and record. Place in wire tray. Sample should not be compressed or overhang on tray edges. (Note: On air duct products, remove shiplaps and overspray.)

3.3 Place specimen in furnace at 540 °C (1,000 °F), ±10 °C (50 °F) for 15 to 20 minutes to insure complete oxidation. After ignition, fibers should be white and should not be fused together.

3.4 Remove specimen from the furnace and cool to room temperature.

3.5 Weigh cooled specimen to the nearest 0.1 gram. Deduct the weight of the wire tray and then calculate the loss in weight as a percent of the original specimen weight.

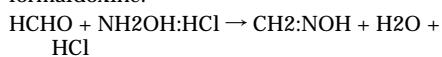
Appendix B to Subpart NNN—Free Formaldehyde Analysis of Insulation Resins by Hydroxylamine Hydrochloride

1. Scope.

This method was specifically developed for water-soluble phenolic resins that have a relatively high free-formaldehyde (FF) content such as insulation resins. It may also be suitable for other phenolic resins, especially those with a high FF content.

2. Principle.

2.1 a. The basis for this method is the titration of the hydrochloric acid that is liberated when hydroxylamine hydrochloride reacts with formaldehyde to form formaldoxime:



b. Free formaldehyde in phenolic resins is present as monomeric formaldehyde, hemiformals, polyoxymethylene hemiformals, and polyoxymethylene glycols. Monomeric formaldehyde and hemiformals react rapidly with hydroxylamine hydrochloride, but the polymeric forms of formaldehyde must hydrolyze to the monomeric state before they can react. The greater the concentration of free formaldehyde in a resin, the more of that formaldehyde will be in the polymeric form. The hydrolysis of these polymers is catalyzed by hydrogen ions.

2.2 The resin sample being analyzed must contain enough free formaldehyde so that the initial reaction with hydroxylamine hydrochloride will produce sufficient hydrogen ions to catalyze the depolymerization of the polymeric formaldehyde within the time limits of the test method. The sample should contain approximately 0.3 grams free formaldehyde

to ensure complete reaction within 5 minutes.

3. Apparatus.

3.1 Balance, readable to 0.01 g or better.

3.2 pH meter, standardized to pH 4.0 with pH 4.0 buffer and pH 7 with pH 7.0 buffer.

3.3 50-mL burette for 1.0 N sodium hydroxide.

3.4 Magnetic stirrer and stir bars.

3.5 250-mL beaker.

3.6 50-mL graduated cylinder.

3.7 100-mL graduated cylinder.

3.8 Timer.

4. Reagents.

4.1 Standardized 1.0 N sodium hydroxide solution.

4.2 Hydroxylamine hydrochloride solution, 100 grams per liter, pH adjusted to 4.00.

4.3 Hydrochloric acid solution, 1.0 N and 0.1 N.

4.4 Sodium hydroxide solution, 0.1 N.

4.5 50/50 v/v mixture of distilled water and methyl alcohol.

5. Procedure.

5.1 Determine the sample size as follows:

a. If the expected FF is greater than 2 percent, go to Part A to determine sample size.

b. If the expected FF is less than 2 percent, go to Part B to determine sample size.

c. Part A: Expected FF ≥ 2 percent. Grams resin = 60/expected percent FF.

1. The following table shows example levels:

Expected percent free formaldehyde	Sample size, grams
2	30.0
5	12.0

Expected percent free formaldehyde	Sample size, grams
8	7.5
10	6.0
12	5.0
15	4.0

ii. It is very important to the accuracy of the results that the sample size be chosen correctly. If the milliliters of titrant are less than 15 mL or greater than 30 mL, reestimate the needed sample size and repeat the tests.

d. Part B: Expected FF < 2 percent Grams resin = 30/expected percent FF.

i. The following table shows example levels:

Expected percent free formaldehyde	Sample size, grams
2	15
1	30
0.5	60

ii. If the milliliters of titrant are less than 5 mL or greater than 30 mL, reestimate the needed sample size and repeat the tests.

5.2 Weigh the resin sample to the nearest 0.01 grams into a 250-mL beaker. Record sample weight.

5.3 Add 100 mL of the methanol/water mixture and stir on a magnetic stirrer. Confirm that the resin has dissolved.

5.4 Adjust the resin/solvent solution to pH 4.0, using the prestandardized pH meter, 1.0 N hydrochloric acid, 0.1 N hydrochloric acid, and 0.1 N sodium hydroxide.

5.5 Add 50 mL of the hydroxylamine hydrochloride solution, measured with a graduated cylinder. Start the timer.

5.6 Stir for 5 minutes. Titrate to pH 4.0 with standardized 1.0 N sodium hydroxide. Record the milliliters of titrant and the normality.

6. Calculations.

$$\% \text{ FF} = \frac{\text{mL sodium hydroxide} \times \text{normality} \times 3.003}{\text{grams of sample}}$$

7. Method precision and accuracy.

Test values should conform to the following statistical precision: Variance =

0.005; Standard deviation = 0.07; 95% Confidence Interval, for a single determination = 0.2.

8. Author.

This method was prepared by K. K. Tutin and M. L. Foster, Tacoma R&D Laboratory, Georgia-Pacific Resins, Inc. (Principle written by R. R. Conner.)

9. References.

9.1 GPAM 2221.2.

9.2 PR&C TM 2.035.

9.3 Project Report, Comparison of Free Formaldehyde Procedures, January 1990, K. K. Tutin.

Appendix C to Subpart NNN—Method for the Determination of Product Density

1. Purpose.

The purpose of this test is to determine the product density of cured blanket insulation. The method is applicable to all cured board and blanket products.

2. Equipment.

One square foot (12 in. by 12 in.) template, or templates that are multiple of one square foot, for use in cutting insulation samples.

3. Procedure.

3.1 Obtain a sample at least 30 in. long across the machine width. Sample should be free of dirt or foreign matter.

3.2 Lay out the cutting pattern according to the plants written procedure for the designated product.

3.2 Cut samples using one square foot (or multiples of one square foot) template.

3.3 Weigh product and obtain area weight (lb/ft²).

3.4 Measure sample thickness.

3.5 Calculate the product density:

$$\text{Density (lb/ft}^3\text{)} = \text{area weight (lb/ft}^2\text{)} / \text{thickness (ft)}$$

3. Appendix A to part 63 is amended by adding in numerical order methods 316 and 318 to read as follows:

APPENDIX A TO PART 63—TEST METHODS

* * * * *

Method 316—Sampling and Analysis for Formaldehyde Emissions from Stationary Sources in the Mineral Wool and Wool Fiberglass Industries

1.0 Introduction.

This method is applicable to the determination of formaldehyde, CAS Registry number 50-00-0, from stationary sources in the mineral wool and wool fiber glass industries. High purity water is used to collect the formaldehyde. The formaldehyde concentrations in the stack samples are determined using the modified Pararosaniline Method. Formaldehyde can be detected as low as 8.8×10^{-10} lbs/cu ft (11.3 ppbv) or as high as 1.8×10^3 lbs/cu ft (23,000,000 ppbv), at standard conditions over a 1 hour sampling period, sampling approximately 30 cu ft.

2.0 Summary of Method.

Gaseous and particulate pollutants are withdrawn isokinetically from an emission source and are collected in high purity water. Formaldehyde present in the emissions is highly soluble in high purity water. The high purity water containing formaldehyde is then analyzed using the modified pararosaniline method. Formaldehyde in the sample reacts with acidic pararosaniline, and the sodium sulfite, forming a purple chromophore. The intensity of the purple color, measured spectrophotometrically, provides an accurate and precise measure of the formaldehyde concentration in the sample.

3.0 Definitions.

See the definitions in the General Provisions in subpart A of this part.

4.0 Interferences.

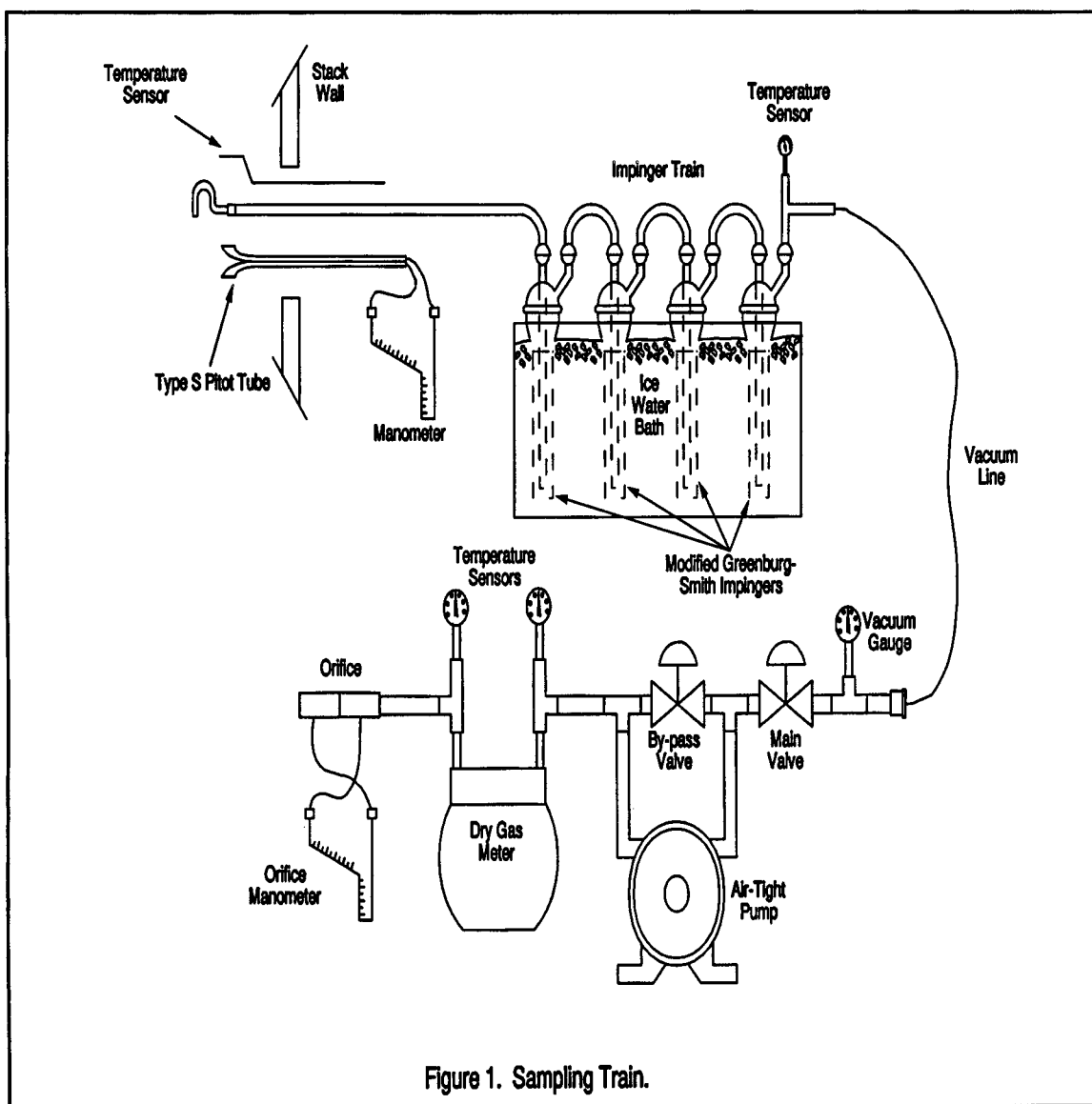
Sulfite and cyanide in solution interfere with the pararosaniline method. A procedure to overcome the interference by each compound has been described by Miksch, et al.

5.0 Safety. [Reserved]

6.0 Apparatus and Materials.

6.1 A schematic of the sampling train is shown in Figure 1. This sampling train configuration is adapted from EPA Method 5, 40 CFR part 60, appendix A, procedures. The sampling train consists of the following components: probe nozzle, probe liner, pitot tube, differential pressure gauge, impingers, metering system, barometer, and gas density determination equipment. Figure 1 is as follows:

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6.1.1 Probe Nozzle: Quartz, glass, or stainless steel with sharp, tapered (30° angle) leading edge. The taper shall be on the outside to preserve a constant inner diameter. The nozzle shall be buttonhook or elbow design. A range of nozzle sizes suitable for isokinetic sampling should be available in increments of 0.15 cm (1/16 in), e.g., 0.32 to 1.27 cm (1/8 to 1/2 in), or larger if higher volume sampling trains are used. Each nozzle shall be calibrated according to the procedure outlined in Section 10.1.

6.1.2 Probe Liner: Borosilicate glass or quartz shall be used for the probe liner. The probe shall be maintained at a temperature of 120°C ± 14°C (248°F ± 25°F).

6.1.3 Pitot Tube: The Pitot tube shall be Type S, as described in Section 2.1 of EPA Method 2, 40 CFR part 60, appendix A, or any other appropriate device. The pitot tube shall be attached to the probe to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see Figure 2-6b, EPA Method 2, 40 CFR part 60, appendix A) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of EPA Method 2, 40 CFR part 60, appendix A.

6.1.4 Differential Pressure Gauge: The differential pressure gauge shall be an inclined manometer or equivalent device as described in Section 2.2 of EPA Method 2, 40 CFR part 60, appendix A. One manometer shall be used for velocity-head reading and the other for orifice differential pressure readings.

6.1.5 Impingers: The sampling train requires a minimum of four impingers, connected as shown in Figure 1, with ground glass (or equivalent) vacuum-tight fittings. For the first, third, and fourth impingers, use the Greenburg-Smith design, modified by replacing the tip with a 1.3 cm inside diameter (1/2 in) glass tube extending to 1.3 cm (1/2 in) from the bottom of the flask. For the second impinger, use a Greenburg-Smith impinger with the standard tip. Place a thermometer capable of measuring temperature to within 1°C (2°F) at the outlet of the fourth impinger for monitoring purposes.

6.1.6 Metering System: The necessary components are a vacuum gauge, leak-free pump, thermometers capable of measuring temperatures within 3°C (5.4°F), dry-gas meter capable of measuring volume to within 1 percent, and related equipment as shown in Figure 1. At a minimum, the pump should be capable of 4 cfm free flow, and the dry gas meter should have a recording capacity of 0-999.9 cu ft with a resolution of 0.005 cu ft. Other metering systems may be used which are capable of maintaining sample volumes to within 2 percent. The metering system may be used in conjunction with a pitot tube to enable checks of isokinetic sampling rates.

6.1.7 Barometer: The barometer may be mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in Hg). In many cases, the barometric reading may be obtained from a nearby National Weather Service Station, in which case the station value (which is the

absolute barometric pressure) is requested and an adjustment for elevation differences between the weather station and sampling point is applied at a rate of minus 2.5 mm Hg (0.1 in Hg) per 30 m (100 ft) elevation increases (vice versa for elevation decrease).

6.1.8 Gas Density Determination Equipment: Temperature sensor and pressure gauge (as described in Sections 2.3 and 2.3 of EPA Method 2, 40 CFR part 60, appendix A), and gas analyzer, if necessary (as described in EPA Method 3, 40 CFR part 60, appendix A). The temperature sensor ideally should be permanently attached to the pitot tube or sampling probe in a fixed configuration such that the top of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot openings (see Figure 2-7, EPA Method 2, 40 CFR part 60, appendix A). As a second alternative, if a difference of no more than 1 percent in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube.

6.2 Sample Recovery.

6.2.1 Probe Liner: Probe nozzle and brushes; bristle brushes with stainless steel wire handles are required. The probe brush shall have extensions of stainless steel, Teflon, or inert material at least as long as the probe. The brushes shall be properly sized and shaped to brush out the probe liner, the probe nozzle, and the impingers.

6.2.2 Wash Bottles: One wash bottle is required. Polyethylene, teflon, or glass wash bottles may be used for sample recovery.

6.2.3 Graduate Cylinder and/or Balance: A graduated cylinder or balance is required to measure condensed water to the nearest 1 ml or 1 g. Graduated cylinders shall have division not >2 ml. Laboratory balances capable of weighing to ± 0.5 g are required.

6.2.4 Polyethylene Storage Containers: 500 ml wide-mouth polyethylene bottles are required to store impinger water samples.

6.2.5 Rubber Policeman and Funnel: A rubber policeman and funnel are required to aid the transfer of material into and out of containers in the field.

6.3 Sample Analysis.

6.3.1 Spectrophotometer—B&L 70, 710, 2000, etc., or equivalent; 1 cm pathlength cuvette holder.

6.3.2 Disposable polystyrene cuvettes, pathlength 1 cm, volume of about 4.5 ml.

6.3.3 Pipettors—Fixed-volume Oxford pipet (250 µl; 500 µl; 1000 µl); adjustable volume Oxford or equivalent pipettor 1-5 mℓ model, set to 2.50 ml.

6.3.4 Pipet tips for pipettors above.

6.3.5 Parafilm, 2° wide; cut into about 1" squares.

7.0 Reagents.

7.1 High purity water: All references to water in this method refer to high purity water (ASTM Type I water or equivalent). The water purity will dictate the lower limits of formaldehyde quantification.

7.2 Silica Gel: Silica gel shall be indicating type, 6-16 mesh. If the silica gel has been

used previously, dry at 175°C (350°F) for 2 hours before using. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used.

7.3 Crushed Ice: Quantities ranging from 10-50 lbs may be necessary during a sampling run, depending upon ambient temperature. Samples which have been taken must be stored and shipped cold; sufficient ice for this purpose must be allowed.

7.4 Quaternary ammonium compound stock solution: Prepare a stock solution of dodecyltrimethylammonium chloride (98 percent minimum assay, reagent grade) by dissolving 1.0 gram in 1000 ml water. This solution contains nominally 1000 µg/ml quaternary ammonium compound, and is used as a biocide for some sources which are prone to microbial contamination.

7.5 Pararosaniline: Weigh 0.16 grams pararosaniline (free base; assay of 95 percent or greater, C.I. 42500; Sigma P7632 has been found to be acceptable) into a 100 ml flask. Exercise care, since pararosaniline is a dye and will stain. Using a wash bottle with high-purity water, rinse the walls of the flask. Add no more than 25 ml water. Then, carefully add 20 ml of concentrated hydrochloric acid to the flask. The flask will become warm after the addition of acid. Add a magnetic stir bar to the flask, cap, and place on a magnetic stirrer for approximately 4 hours. Then, add additional water so the total volume is 100 ml. This solution is stable for several months when stored tightly capped at room temperature.

7.6 Sodium sulfite: Weigh 0.10 grams anhydrous sodium sulfite into a 100 ml flask. Dilute to the mark with high purity water. Invert 15-20 times to mix and dissolve the sodium sulfite. This solution MUST BE PREPARED FRESH EVERY DAY.

7.7 Formaldehyde standard solution: Pipet exactly 2.70 ml of 37 percent formaldehyde solution into a 1000 ml volumetric flask which contains about 500 ml of high-purity water. Dilute to the mark with high-purity water. This solution contains nominally 1000 µg/ml of formaldehyde, and is used to prepare the working formaldehyde standards. The exact formaldehyde concentration may be determined if needed by suitable modification of the sodium sulfite method (Reference: J.F. Walker, FORMALDEHYDE (Third Edition), 1964.). The 1000 µg/ml formaldehyde stock solution is stable for at least a year if kept tightly closed, with the neck of the flask sealed with Parafilm. Store at room temperature.

7.8 a. Working formaldehyde standards: Pipet exactly 10.0 ml of the 1000 µg/ml formaldehyde stock solution into a 100 ml volumetric flask which is about half full of high-purity water. Dilute to the mark with high-purity water, and invert 15-20 times to mix thoroughly.

This solution contains nominally 100 µg/ml formaldehyde. Prepare the working standards from this 100 µg/ml standard solution and using the Oxford pipets:

Working standard, $\mu\text{g/mL}$	μL or 100 $\mu\text{g/mL}$ solution	Volumetric flask volume (dilute to mark with water)
0.250	250	100
0.500	500	100
1.00	1000	100
2.00	2000	100
3.00	1500	50

b. The 100 $\mu\text{g/mL}$ stock solution is stable for 4 weeks if kept refrigerated between analyses. The working standards (0.25–3.00 $\mu\text{g/mL}$) should be prepared fresh every day, consistent with good laboratory practice for trace analysis. If the laboratory water is not of sufficient purity, it may be necessary to prepare the working standards EVERY DAY. The laboratory MUST ESTABLISH that the working standards are stable—DO NOT assume that your working standards are stable for more than a day unless you have verified this by actual testing for several series of working standards.

8.0 Sample Collection.

8.1 Because of the complexity of this method, field personnel should be trained in and experienced with the test procedures in order to obtain reliable results.

8.2 Laboratory Preparation:

8.2.1 All the components shall be maintained and calibrated according to the procedure described in APTD–0576, unless otherwise specified.

8.2.2 Weigh several 200 to 300 g portions of silica gel in airtight containers to the nearest 0.5 g. Record on each container the total weight of the silica gel plus containers. As an alternative to preweighing the silica gel, it may instead be weighed directly in the impinger or sampling holder just prior to train assembly.

8.3 Preliminary Field Determinations.

8.3.1 Select the sampling site and the minimum number of sampling points according to EPA Method 1, 40 CFR part 60, appendix A, or other relevant criteria. Determine the stack pressure, temperature, and range of velocity heads using EPA Method 2, 40 CFR part 60, appendix A. A leak-check of the pitot lines according to Section 3.1 of EPA Method 2, 40 CFR part 60, appendix A, must be performed. Determine the stack gas moisture content using EPA Approximation Method 4, 40 CFR part 60, appendix A, or its alternatives to establish estimates of isokinetic sampling rate settings. Determine the stack gas dry molecular weight, as described in EPA Method 2, 40 CFR part 60, appendix A, Section 3.6. If integrated EPA Method 3, 40 CFR part 60, appendix A, sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the sample run.

8.3.2 Select a nozzle size based on the range of velocity heads so that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates below 28 l/min (1.0 cfm). During the run do not change the nozzle. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see

Section 2.2 of EPA Method 2, 40 CFR part 60, appendix A).

8.3.3 Select a suitable probe liner and probe length so that all traverse points can be sampled. For large stacks, to reduce the length of the probe, consider sampling from opposite sides of the stack.

8.3.4 A minimum of 30 cu ft of sample volume is suggested for emission sources with stack concentrations not greater than 23,000,000 ppbv. Additional sample volume shall be collected as necessitated by the capacity of the water reagent and analytical detection limit constraint. Reduced sample volume may be collected as long as the final concentration of formaldehyde in the stack sample is 10 (ten) times the detection limit.

8.3.5 Determine the total length of sampling time needed to obtain the identified minimum volume by comparing the anticipated average sampling rate with the volume requirement. Allocate the same time to all traverse points defined by EPA Method 1, 40 CFR part 60, appendix A. To avoid timekeeping errors, the length of time sampled at each traverse point should be an integer or an integer plus 0.5 min.

8.3.6 In some circumstances (e.g., batch cycles) it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas-volume samples. In these cases, careful documentation must be maintained in order to allow accurate calculations of concentrations.

8.4 Preparation of Collection Train.

8.4.1 During preparation and assembly of the sampling train, keep all openings where contamination can occur covered with Teflon film or aluminum foil until just prior to assembly or until sampling is about to begin.

8.4.2 Place 100 ml of water in each of the first two impingers, and leave the third impinger empty. If additional capacity is required for high expected concentrations of formaldehyde in the stack gas, 200 ml of water per impinger may be used or additional impingers may be used for sampling. Transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. Care should be taken to ensure that the silica gel is not entrained and carried out from the impinger during sampling. Place the silica gel container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

8.4.3 With a glass or quartz liner, install the selected nozzle using a Viton-A O-ring when stack temperatures are < 260°C (500°F) and a woven glass-fiber gasket when temperatures are higher. See APTD–0576 for details. Other connection systems utilizing either 316 stainless steel or Teflon ferrules may be used. Mark the probe with heat-resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

8.4.4 Assemble the train as shown in Figure 1. During assembly, a very light coating of silicone grease may be used on ground-glass joints of the impingers, but the silicone grease should be limited to the outer portion (see APTD–0576) of the ground-glass joints to minimize silicone grease contamination. If necessary, Teflon tape may

be used to seal leaks. Connect all temperature sensors to an appropriate potentiometer/display unit. Check all temperature sensors at ambient temperatures.

8.4.5 Place crushed ice all around the impingers.

8.4.6 Turn on and set the probe heating system at the desired operating temperature. Allow time for the temperature to stabilize.

8.5 Leak-Check Procedures.

8.5.1 Pre-test Leak-check: Recommended, but not required. If the tester elects to conduct the pre-test leak-check, the following procedure shall be used.

8.5.1.1 a. After the sampling train has been assembled, turn on and set probe heating system at the desired operating temperature. Allow time for the temperature to stabilize. If a Viton-A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 381 mm Hg (15 in Hg) vacuum. (Note: A lower vacuum may be used, provided that the lower vacuum is not exceeded during the test.)

b. If a woven glass fiber gasket is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first attaching a carbon-filled leak-check impinger to the inlet and then plugging the inlet and pulling a 381 mm Hg (15 in Hg) vacuum. (A lower vacuum may be used if this lower vacuum is not exceeded during the test.) Next connect the probe to the train and leak-check at about 25 mm Hg (1 in Hg) vacuum. Alternatively, leak-check the probe with the rest of the sampling train in one step at 381 mm Hg (15 in Hg) vacuum. Leakage rates in excess of (a) 4 percent of the average sampling rate or (b) 0.00057 m³/min (0.02 cfm), whichever is less, are unacceptable.

8.5.1.2 The following leak-check instructions for the sampling train described in APTD–0576 and APTD–0581 may be helpful. Start the pump with the fine-adjust valve fully open and coarse-valve completely closed. Partially open the coarse-adjust valve and slowly close the fine-adjust valve until the desired vacuum is reached. Do not reverse direction of the fine-adjust valve, as liquid will back up into the train. If the desired vacuum is exceeded, either perform the leak-check at this higher vacuum or end the leak-check, as described below, and start over.

8.5.1.3 When the leak-check is completed, first slowly remove the plug from the inlet to the probe. When the vacuum drops to 127 mm (5 in) Hg or less, immediately close the coarse-adjust valve. Switch off the pumping system and reopen the fine-adjust valve. Do not reopen the fine-adjust valve until the coarse-adjust valve has been closed to prevent the liquid in the impingers from being forced backward in the sampling line and silica gel from being entrained backward into the third impinger.

8.5.2 Leak-checks During Sampling Run:

8.5.2.1 If, during the sampling run, a component change (e.g., impinger) becomes necessary, a leak-check shall be conducted immediately after the interruption of sampling and before the change is made. The leak-check shall be done according to the procedure described in Section 10.3.3, except

that it shall be done at a vacuum greater than or equal to the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.0057 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable. If a higher leakage rate is obtained, the tester must void the sampling run. (Note: Any correction of the sample volume by calculation reduces the integrity of the pollutant concentration data generated and must be avoided.)

8.5.2.2 Immediately after component changes, leak-checks are optional. If performed, the procedure described in section 6.5.1.1 shall be used.

8.5.3 Post-test Leak-check:

8.5.3.1 A leak-check is mandatory at the conclusion of each sampling run. The leak-

check shall be done with the same procedures as the pre-test leak-check, except that the post-test leak-check shall be conducted at a vacuum greater than or equal to the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable. If, however, a higher leakage rate is obtained, the tester shall record the leakage rate and void the sampling run.

8.6 Sampling Train Operation.

8.6.1 During the sampling run, maintain an isokinetic sampling rate to within 10 percent of true isokinetic, below 28 l/min (1.0 cfm). Maintain a temperature around the probe of 120°C ± 14°C (248° ± 25°F).

8.6.2 For each run, record the data on a data sheet such as the one shown in Figure 2. Be sure to record the initial dry-gas meter reading. Record the dry-gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak-check, and when sampling is halted. Take other readings required by Figure 2 at least once at each sample point during each time increment and additional readings when significant adjustments (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

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Figure 2. Formaldehyde Field Data

Plant
 Location
 Operator
 Date
 Run No
 Sample box No
 Meter box No
 Meter ΔH
 C Factor
 Pitot tube coefficient, Op

Ambient temperature
 Barometric pressure
 Assumed moisture, percent
 Probe length, m (ft)
 Nozzle Identification No
 Average calibrated nozzle
 diameter, cm (in.)
 Probe heater setting
 Leak rate, m³/min (cfm)
 Probe liner material
 Static pressure, mm Hg (in. Hg) .
 Filter No.

SCHEMATIC OF STACK CROSS SECTION

Figure 2. Formaldehyde Field Data--Continued

Traverse point number	Sampling time (e) min.	Vacuum mm Hg (in. Hg)	Stack temper- ature (T) °C (°F)	Velocity head (ΔP) mm (in) H ₂ O	Pressure differ- ential across orifice meter mm H ₂ O (in. H ₂ O)	Gas sample volume m ³ (ft ³)	Gas sample temperature at dry gas meter		Filter holder temper- ature °C (°F)	Temperature of gas leaving condenser or last impinger °C (°F)
							Inlet °C (°F)	Outlet °C (°F)		
Total							Avg.	Avg.		
Average							Avg.			

8.6.3 Clean the stack access ports prior to the test run to eliminate the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the probe heating system are at the specified temperature, and verify that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point, with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations, are available. These nomographs are designed for use when the Type S pitot tube coefficient is 0.84 ± 0.02 and the stack gas equivalent density (dry molecular weight) is equal to 29 ± 4 . APTD-0576 details the procedure for using the nomographs. If the stack gas molecular weight and the pitot tube coefficient are outside the above ranges, do not use the nomographs unless appropriate steps are taken to compensate for the deviations.

8.6.4 When the stack is under significant negative pressure (equivalent to the height of the impinger stem), take care to close the coarse-adjust valve before inserting the probe into the stack in order to prevent liquid from backing up through the train. If necessary, a low vacuum on the train may have to be started prior to entering the stack.

8.6.5 When the probe is in position, block off the openings around the probe and stack access port to prevent unrepresentative dilution of the gas stream.

8.6.6 Traverse the stack cross section, as required by EPA Method 1, 40 CFR part 60, appendix A, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the access port, in order to minimize the chance of extracting deposited material.

8.6.7 During the test run, make periodic adjustments to keep the temperature around the probe at the proper levels. Add more ice and, if necessary, salt, to maintain a temperature of $< 20^{\circ}\text{C}$ (68°F) at the silica gel outlet.

8.6.8 A single train shall be used for the entire sampling run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or in cases where equipment failure necessitates a change of trains. An additional train or trains may also be used for sampling when the capacity of a single train is exceeded.

8.6.9 When two or more trains are used, separate analyses of components from each train shall be performed. If multiple trains have been used because the capacity of a single train would be exceeded, first impingers from each train may be combined, and second impingers from each train may be combined.

8.6.10 At the end of the sampling run, turn off the coarse-adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak-check. Also, check the pitot lines as described in EPA Method 2, 40 CFR part 60, appendix A. The lines must pass this leak-check in order to validate the velocity-head data.

8.6.11 Calculate percent isokineticity (see Method 2) to determine whether the run was valid or another test should be made.

8.7 Sample Preservation and Handling.

8.7.1 Samples from most sources applicable to this method have acceptable holding times using normal handling practices (shipping samples iced, storing in refrigerator at 2°C until analysis). However, forming section stacks and other sources using waste water sprays may be subject to microbial contamination. For these sources, a biocide (quaternary ammonium compound solution) may be added to collected samples to improve sample stability and method ruggedness.

8.7.2 Sample holding time: Samples should be analyzed within 14 days of collection. Samples must be refrigerated/kept cold for the entire period preceding analysis. After the samples have been brought to room temperature for analysis, any analyses needed should be performed on the same day. Repeated cycles of warming the samples to room temperature/refrigerating/rewarming, then analyzing again, etc., have not been investigated in depth to evaluate if analyte levels remain stable for all sources.

8.7.3 Additional studies will be performed to evaluate whether longer sample holding times are feasible for this method.

8.8 Sample Recovery.

8.8.1 Preparation:

8.8.1.1 Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool. When the probe can be handled safely, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over the tip to prevent losing or gaining particulate matter. Do not cap the probe tightly while the sampling train is cooling because a vacuum will be created, drawing liquid from the impingers back through the sampling train.

8.8.1.2 Before moving the sampling train to the cleanup site, remove the probe from the sampling train and cap the open outlet, being careful not to lose any condensate that might be present. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used, let any condensed water or liquid drain into the impingers. Cap off any open impinger inlets and outlets. Ground glass stoppers, Teflon caps, or caps of other inert materials may be used to seal all openings.

8.8.1.3 Transfer the probe and impinger assembly to an area that is clean and protected from wind so that the chances of contaminating or losing the sample are minimized.

8.8.1.4 Inspect the train before and during disassembly, and note any abnormal conditions.

8.8.1.5 Save a portion of the washing solution (high purity water) used for cleanup as a blank.

8.8.2 Sample Containers:

8.8.2.1 Container 1: Probe and Impinger Catches. Using a graduated cylinder, measure to the nearest ml, and record the volume of the solution in the first three impingers. Alternatively, the solution may be weighed to the nearest 0.5 g. Include any condensate in the probe in this determination. Transfer the

combined impinger solution from the graduated cylinder into the polyethylene bottle. Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, clean all surfaces to which the sample is exposed (including the probe nozzle, probe fitting, probe liner, first three impingers, and impinger connectors) with water. Use less than 400 ml for the entire waste (250 ml would be better, if possible). Add the rinse water to the sample container.

8.8.2.1.1 Carefully remove the probe nozzle and rinse the inside surface with water from a wash bottle. Brush with a bristle brush and rinse until the rinse shows no visible particles, after which make a final rinse of the inside surface. Brush and rinse the inside parts of the Swagelok (or equivalent) fitting with water in a similar way.

8.8.2.1.2 Rinse the probe liner with water. While squirting the water into the upper end of the probe, tilt and rotate the probe so that all inside surfaces will be wetted with water. Let the water drain from the lower end into the sample container. The tester may use a funnel (glass or polyethylene) to aid in transferring the liquid washes to the container. Follow the rinse with a bristle brush. Hold the probe in an inclined position, and squirt water into the upper end as the probe brush is being pushed with a twisting action through the probe. Hold the sample container underneath the lower end of the probe, and catch any water and particulate matter that is brushed from the probe. Run the brush through the probe three times or more. Rinse the brush with water and quantitatively collect these washings in the sample container. After the brushing, make a final rinse of the probe as describe above. (Note: Two people should clean the probe in order to minimize sample losses. Between sampling runs, brushes must be kept clean and free from contamination.)

8.8.2.1.3 Rinse the inside surface of each of the first three impingers (and connecting tubing) three separate times. Use a small portion of water for each rinse, and brush each surface to which the sample is exposed with a bristle brush to ensure recovery of fine particulate matter. Make a final rinse of each surface and of the brush, using water.

8.8.2.1.4 After all water washing and particulate matter have been collected in the sample container, tighten the lid so the sample will not leak out when the container is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container clearly to identify its contents.

8.8.2.1.5 If the first two impingers are to be analyzed separately to check for breakthrough, separate the contents and rinses of the two impingers into individual containers. Care must be taken to avoid physical carryover from the first impinger to the second. Any physical carryover of collected moisture into the second impinger will invalidate a breakthrough assessment.

8.8.2.2 Container 2: Sample Blank. Prepare a blank by using a polyethylene container and adding a volume of water equal to the total volume in Container 1. Process the blank in the same manner as Container 1.

8.8.2.3 Container 3: Silica Gel. Note the color of the indicating silica gel to determine whether it has been completely spent and make a notation of its condition. The impinger containing the silica gel may be used as a sample transport container with both ends sealed with tightly fitting caps or plugs. Ground-glass stoppers or Teflon caps may be used. The silica gel impinger should then be labeled, covered with aluminum foil, and packaged on ice for transport to the laboratory. If the silica gel is removed from the impinger, the tester may use a funnel to pour the silica gel and a rubber policeman to remove the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use water or other liquids to transfer the silica gel. If a balance is available in the field, the spent silica gel (or silica gel plus impinger) may be weighed to the nearest 0.5 g.

8.8.2.4 Sample containers should be placed in a cooler, cooled by (although not in contact with) ice. Putting sample bottles in zip-lock bags can aid in maintaining the integrity of the sample labels. Sample containers should be placed vertically to avoid leakage during shipment. Samples should be cooled during shipment so they will be received cold at the laboratory. It is critical that samples be chilled immediately after recovery. If the source is susceptible to microbial contamination from wash water (e.g.) forming section stack), add biocide as directed in section 8.2.5.

8.8.2.5 A quaternary ammonium compound can be used as a biocide to stabilize samples against microbial degradation following collection. Using the stock quaternary ammonium compound (QAC) solution; add 2.5 ml QAC solution for every 100 ml of recovered sample volume (estimate of volume is satisfactory) immediately after collection. The total volume of QAC solution must be accurately known and recorded to correct for any dilution caused by the QAC solution addition.

8.8.3 Sample Preparation for Analysis

8.8.3.1 The sample should be refrigerated if the analysis will not be performed on the day of sampling. Allow the sample to warm at room temperature for about two hours (if it has been refrigerated) prior to analyzing.

8.8.3.2 Analyze the sample by the pararosaniline method, as described in Section 11. If the color-developed sample has an absorbance above the highest standard, a suitable dilution in high purity water should be prepared and analyzed.

9. Quality Control.

9.1 Sampling: See EPA Manual 600/4-77-02b for Method 5 quality control.

9.2 Analysis: The quality assurance program required for this method includes the analysis of the field and method blanks, and procedure validations. The positive identification and quantitation of formaldehyde are dependent on the integrity of the samples received and the precision and accuracy of the analytical methodology. Quality assurance procedures for this method are designed to monitor the performance of

the analytical methodology and to provide the required information to take corrective action if problems are observed in laboratory operations or in field sampling activities.

9.2.1 Field Blanks: Field blanks must be submitted with the samples collected at each sampling site. The field blanks include the sample bottles containing aliquots of sample recovery water, and water reagent. At a minimum, one complete sampling train will be assembled in the field staging area, taken to the sampling area, and leak-checked at the beginning and end of the testing (or for the same total number of times as the actual sampling train). The probe of the blank train must be heated during the sample test. The train will be recovered as if it were an actual test sample. No gaseous sample will be passed through the blank sampling train.

9.2.2 Blank Correction: The field blank formaldehyde concentrations will be subtracted from the appropriate sample formaldehyde concentrations. Blank formaldehyde concentrations above 0.25 µg/ml should be considered suspect, and subtraction from the sample formaldehyde concentrations should be performed in a manner acceptable to the applicable administrator.

9.2.3 Method Blanks: A method blank must be prepared for each set of analytical operations, to evaluate contamination and artifacts that can be derived from glassware, reagents, and sample handling in the laboratory.

10. Calibration.

10.1 Probe Nozzle: Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in). Make measurements at three separate places across the diameter and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in). When the nozzle becomes nicked or corroded, it shall be repaired and calibrated, or replaced with a calibrated nozzle before use. Each nozzle must be permanently and uniquely identified.

10.2 Pitot Tube: The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of EPA Method 2, or assigned a nominal coefficient of 0.84 if it is not visibly nicked or corroded and if it meets design and intercomponent spacing specifications.

10.3 Metering System.

10.3.1 Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry-gas meter dial readings to correspond to the wet-test meter readings, calibration factors may be used to correct the gas meter dial readings mathematically to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not delete leakages with the pump. For these cases, the following leak-check procedure will apply: make a ten-minute calibration run at 0.00057 m³/min (0.02 cfm). At the end of the run, take the difference of the measured wet-test and dry-

gas meter volumes and divide the difference by 10 to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

10.3.2 After each field use, check the calibration of the metering system by performing three calibration runs at a single intermediate orifice setting (based on the previous field test). Set the vacuum at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet-test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

10.3.3 Leak-check of metering system: The portion of the sampling train from the pump to the orifice meter (see Figure 1) should be leak-checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. Use the following procedure: Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13–18 cm (5–7 in) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for 1 min. A loss of pressure on the manometer indicates a leak in the meter box. Leaks must be corrected. (Note: If the dry-gas meter coefficient values obtained before and after a test series differ by >5 percent, either the test series must be voided or calculations for test series must be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.)

10.4 Probe Heater: The probe heating system must be calibrated before its initial use in the field according to the procedure outlined in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

10.5 Temperature gauges: Use the procedure in section 4.3 of USEPA Method 2 to calibrate in-stack temperature gauges. Dial thermometers such as are used for the dry gas meter and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

10.6 Barometer: Adjust the barometer initially and before each test series to agree to within ± 2.5 mm Hg (0.1 in Hg) of the mercury barometer or the correct barometric pressure value reported by a nearby National Weather Service Station (same altitude above sea level).

10.7 Balance: Calibrate the balance before each test series, using Class S standard weights. The weights must be within ± 0.5 percent of the standards, or the balance must be adjusted to meet these limits.

11.0 Procedure for Analysis.

a. The working formaldehyde standards (0.25, 0.50, 1.0, 2.0, and 3.0 µg/ml) are analyzed and a calibration curve is calculated for each day's analysis. The standards should be analyzed first to ensure that the method is working properly prior to analyzing the

samples. In addition, a sample of the high-purity water should also be analyzed and used as a "0" formaldehyde standard.

b. The procedure for analysis of samples and standards is identical: Using the pipet set to 2.50 ml, pipet 2.50 ml of the solution to be analyzed into a polystyrene cuvette. Using the 250 μ l pipet, pipet 250 μ l of the pararosaniline reagent solution into the cuvette. Seal the top of the cuvette with a Parafilm square and shake at least 30 seconds to ensure the solution in the cuvette is well-mixed. Peel back a corner of the Parafilm so the next reagent can be added. Using the 250 μ l pipet, pipet 250 μ l of the sodium sulfite reagent solution into the cuvette. Reseal the cuvette with the Parafilm, and again shake for about 30 seconds to mix the solution in the cuvette. Record the time of addition of the sodium sulfite and let the color develop at room temperature for 60 minutes. Set the spectrophotometer to 570 nm and set to read in Absorbance Units. The spectrophotometer should be equipped with a holder for the 1-cm pathlength cuvettes. Place cuvette(s) containing high-purity water in the spectrophotometer and adjust to read 0.000 AU.

c. After the 60 minutes color development period, read the standard and samples in the spectrophotometer. Record the Absorbance reading for each cuvette. The calibration curve is calculated by linear regression, with the formaldehyde concentration as the "x" coordinate of the pair, and the absorbance reading as the "y" coordinate. The procedure is very reproducible, and typically will yield values similar to these for the calibration curve:

Correlation Coefficient: 0.9999

Slope: 0.50

Y-Intercept: 0.090

d. The formaldehyde concentration of the samples can be found by using the trend-line feature of the calculator or computer program used for the linear regression. For example, the TI-55 calculators use the "X" key (this gives the predicted formaldehyde concentration for the value of the absorbance you key in for the sample). Multiply the formaldehyde concentration from the sample by the dilution factor, if any, for the sample to give the formaldehyde concentration of the original, undiluted, sample (units will be micrograms/ml).

11.1 Notes on the Pararosaniline Procedure.

11.1.1 The pararosaniline method is temperature-sensitive. However, the small fluctuations typical of a laboratory will not significantly affect the results.

11.1.2 The calibration curve is linear to beyond 4 μ g/ml formaldehyde, however, a research-grade spectrophotometer is required to reproducibly read the high absorbance values. Consult your instrument manual to evaluate the capability of the spectrophotometer.

11.1.3 The quality of the laboratory water used to prepare standards and make dilutions is critical. It is important that the cautions given in the Reagents section be observed. This procedure allows quantitation of formaldehyde at very low levels, and thus it is imperative to avoid contamination from other sources of formaldehyde and to exercise the degree of care required for trace analyses.

11.1.4 The analyst should become familiar with the operation of the Oxford or equivalent pipettors before using them for an analysis. Follow the instructions of the manufacturer; one can pipet water into a tared container on any analytical balance to check pipet accuracy and precision. This will also establish if the proper technique is being used. Always use a new tip for each pipetting operation.

11.1.5 This procedure follows the recommendations of ASTM Standard Guide D 3614, reading all solutions versus water in the reference cell. This allows the absorbance of the blank to be tracked on a daily basis. Refer to ASTM D 3614 for more information.

12.0 Calculations.

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculations.

12.1 Calculations of Total Formaldehyde.

12.1.1 To determine the total formaldehyde in mg, use the following equation if biocide was not used:

Total mg formaldehyde=

$$C_d \times V \times DF \times 0.001 \text{ mg}/\mu\text{g}$$

Where:

C_d =measured conc. formaldehyde, " μ g/ml";

V =total volume of stack sample, ml;

DF =dilution factor.

12.1.2 To determine the total formaldehyde in mg, use the following equation if biocide was used:

Total mg formaldehyde=

$$\frac{C_d \times V}{(V - B) \times DF \times 0.001 \text{ mg}/\mu\text{g}}$$

Where:

C_d =measured conc. formaldehyde, μ g/ml;

V =total volume of stack sample, ml;

B =total volume of biocide added to sample, ml;

DF =dilution factor.

12.2 Formaldehyde concentration (mg/ m^3) in stack gas. Determine the formaldehyde concentration (mg/ m^3) in the stack gas using the following equation:

Formaldehyde concentration (mg/ m^3)=

$$\frac{K \times [\text{total formaldehyde, mg}]}{V_m(\text{std})}$$

Where:

$K=35.31 \text{ cu ft}/m^3$ for $V_m(\text{std})$ in English units, or

$K=1.00 \text{ m}^3/m^3$ for $V_m(\text{std})$ in metric units;

$V_m(\text{std})$ =volume of gas sample measured by a dry gas meter, corrected to standard conditions, dscm (dscf).

12.3 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop are obtained from the data sheet.

12.4 Dry Gas Volume: Calculate $V_m(\text{std})$ and adjust for leakage, if necessary, using the equation in Section 6.3 of EPA Method 5, 40 CFR part 60, appendix A.

12.5 Volume of Water Vapor and Moisture Content: Calculated the volume of water vapor and moisture content from equations 5-2 and 5-3 of EPA Method 5.

13.0 Method Performance.

The precision of this method is estimated to be better than ± 5 percent, expressed as \pm the percent relative standard deviation.

14.0 Pollution Prevention. (Reserved)

15.0 Waste Management. (Reserved)

16.0 References.

US EPA 40 CFR, Part 60, Appendix A, Test Methods 1-5

Method 318—Extractive FTIR Method for the Measurement of Emissions from the Mineral Wool and Wool Fiberglass Industries

1. Scope and Application

1.1 Scope. The analytes measured by this method and their CAS numbers are:

Carbon Monoxide: 630-08-0

Carbonyl Sulfide: 463-58-1

Formaldehyde: 50-00-0

Methanol: 1455-13-6

Phenol: 108-95-2

1.2 Applicability.

1.2.1 This method is applicable for the determination of formaldehyde, phenol, methanol, carbonyl sulfide (COS) and carbon monoxide (CO) concentrations in controlled and uncontrolled emissions from manufacturing processes using phenolic resins. The compounds are analyzed in the mid-infrared spectral region (about 400 to 4000 cm^{-1} or 2.5 to 25 μm). Suggested analytical regions are given below (Table 1). Slight deviations from these recommended regions may be necessary due to variations in moisture content and ammonia concentration from source to source.

1.2.2 This method does not apply when:

- (a) polymerization of formaldehyde occurs,
- (b) moisture condenses in either the sampling system or the instrumentation, and (c) when moisture content of the gas stream is so high relative to the analyte concentrations that it causes severe spectral interference.

TABLE 1.—EXAMPLE ANALYTICAL REGIONS

Compound	Analytical Region (cm ⁻¹) FL _m –FU _m	Potential interferants
Formaldehyde	2840.93–2679.83	Water, Methane.
Phenol	1231.32–1131.47	Water, Ammonia, Methane.
Methanol	1041.56–1019.95	Water, Ammonia.
COS ^a	2028.4–2091.9	Water, CO ₂ , CO.
CO ^a	2092.1–2191.8	Water, CO ₂ , COS.

^a Suggested analytical regions assume about 15 percent moisture and CO₂, and that COS and CO have about the same absorbance (in the range of 10 to 50 ppm. If CO and COS are hundreds of ppm or higher, then CO₂ and moisture interference is reduced. If CO or COS is present at high concentration and the other at low concentration, then a shorter cell pathlength may be necessary to measure the high concentration component.

1.3 Method Range and Sensitivity.

1.3.1 The analytical range is a function of instrumental design and composition of the gas stream. Theoretical detection limits depend, in part, on (a) the absorption coefficient of the compound in the analytical frequency region, (b) the spectral resolution, (c) interferometer sampling time, (d) detector sensitivity and response, and (e) absorption pathlength.

1.3.2 Practically, there is no upper limit to the range. The practical lower detection limit is usually higher than the theoretical value, and depends on (a) moisture content of the flue gas, (b) presence of interferants, and (c) losses in the sampling system. In general, a 22 meter pathlength cell in a suitable sampling system can achieve practical detection limits of 1.5 ppm for three compounds (formaldehyde, phenol, and

methanol) at moisture levels up to 15 percent by volume. Sources with uncontrolled emissions of CO and COS may require a 4 meter pathlength cell due to high concentration levels. For these two compounds, make sure absorbance of highest concentration component is <1.0.

1.4 Data Quality Objectives.

1.4.1 In designing or configuring the system, the analyst first sets the data quality objectives, i.e., the desired lower detection limit (DL_i) and the desired analytical uncertainty (AU_i) for each compound. The instrumental parameters (factors b, c, d, and e in Section 1.3.1) are then chosen to meet these requirements, using Appendix D of the FTIR Protocol.

1.4.2 Data quality for each application is determined, in part, by measuring the RMS (Root Mean Square) noise level in each

analytical spectral region (Appendix C of the FTIR Protocol). The RMS noise is defined as the RMSD (Root Mean Square Deviation) of the absorbance values in an analytical region from the mean absorbance value of the region. Appendix D of the FTIR Protocol defines the MAU_{im} (minimum analyte uncertainty of the ith analyte in the mth analytical region). The MAU is the minimum analyte concentration for which the analytical uncertainty limit (AU_i) can be maintained: If the measured analyte concentration is less than MAU_i, then data quality is unacceptable. Table 2 gives some example DL and AU values along with calculated areas and MAU values using the protocol procedures.

TABLE 2.—EXAMPLE PRE-TEST PROTOCOL CALCULATIONS

Protocol value	Form	Phenol	Methanol	Protocol appendix
Reference concentration ^a (ppm-meters)/K	3.016	3.017	5.064	
Reference Band Area	8.2544	16.6417	4.9416	B
DL (ppm-meters)/K	0.1117	0.1117	0.1117	B
AU	0.2	0.2	0.2	B
CL	0.02234	0.02234	0.02234	B
FL	2679.83	1131.47	1019.95	B
FU	2840.93	1231.32	1041.56	B
FC	2760.38	1181.395	1030.755	B
AAI (ppm-meters)/K	0.18440	0.01201	0.00132	B
RMSD	2.28E–03	1.21E–03	1.07E–03	C
MAU (ppm-meters)/K	4.45E–02	7.26E–03	4.68E–03	D
MAU (ppm at 22)	0.0797	0.0130	0.0084	D

^a Concentration units are: ppm concentration of the reference sample (ASC), times the path length of the FTIR cell used when the reference spectrum was measured (meters), divided by the absolute temperature of the reference sample in Kelvin (K), or (ppm-meters)/K.

2.0 Summary of Method.

2.1 Principle.

2.1.1 Molecules are composed of chemically bonded atoms, which are in constant motion. The atomic motions result in bond deformations (bond stretching and bond-angle bending). The number of fundamental (or independent) vibrational motions depends on the number of atoms (N) in the molecule. At typical testing temperatures, most molecules are in the ground-state vibrational state for most of their fundamental vibrational motions. A molecule can undergo a transition from its ground state (for a particular vibration) to the first excited state by absorbing a quantum of

light at a frequency characteristic of the molecule and the molecular motion. Molecules also undergo rotational transitions by absorbing energies in the far-infrared or microwave spectral regions. Rotational transition absorbencies are superimposed on the vibrational absorbencies to give a characteristic shape to each rotational-vibrational absorbance “band.”

2.1.2 Most molecules exhibit more than one absorbance band in several frequency regions to produce an infrared spectrum (a characteristic pattern of bands or a “fingerprint”) that is unique to each molecule. The infrared spectrum of a molecule depends on its structure (bond

lengths, bond angles, bond strengths, and atomic masses). Even small differences in structure can produce significantly different spectra.

2.1.3 Spectral band intensities vary with the concentration of the absorbing compound. Within constraints, the relationship between absorbance and sample concentration is linear. Sample spectra are compared to reference spectra to determine the species and their concentrations.

2.2 Sampling and Analysis.

2.2.1 Flue gas is continuously extracted from the source, and the gas or a portion of the gas is conveyed to the FTIR gas cell, where a spectrum of the flue gas is recorded.

Absorbance band intensities are related to sample concentrations by Beer's Law.

$$A_v = \sum a_i b c_i \quad (1)$$

where:

A_v = absorbance of the i^{th} component at the given frequency, Y

a = absorption coefficient of the i^{th} component at the frequency, Y

b = path length of the cell.

c = concentration of the i^{th} compound in the sample at frequency Y

2.2.2.2 After identifying a compound from the infrared spectrum, its concentration is determined by comparing band intensities in the sample spectrum to band intensities in "reference spectra" of the formaldehyde, phenol, methanol, COS and CO. These reference spectra are available in a permanent soft copy from the EPA spectral library on the EMTIC bulletin board. The source may also prepare reference spectra according to Section 4.5 of the FTIR Protocol. (Note: Reference spectra not prepared according to the FTIR Protocol are not acceptable for use in this test method. Documentation detailing the FTIR Protocol steps used in preparing any non-EPA reference spectra shall be included in each test report submitted by the source.)

2.2.3 Analyte spiking is used for quality assurance. Analyte spiking shall be carried out before the first run (a test consists of three runs) and after the third run. Unless otherwise specified in the applicable regulation, a run shall consist of 8 discrete readings taken by the FTIR over an hour. Therefore, a test shall consist of two analyte spike interferograms (assuming a mixture of compounds was introduced simultaneously for the analyte spike; if each compound was introduced individually, two analyte spike interferograms would be recorded for each target compound), 24 stack sample interferograms, and their corresponding background readings.

2.3 Operator Requirements. The analyst must have some knowledge of source sampling and of infrared spectral patterns to operate the sampling system and to choose a suitable instrument configuration. The analyst should also understand FTIR instrument operation well enough to choose an instrument configuration consistent with the data quality objectives.

3.0 Definitions.

See Appendix A of the FTIR Protocol.

4.0 Interferences.

4.1 Analytical (or Spectral) Interferences. Water vapor. High concentrations of ammonia (hundreds of ppm) may interfere with the analysis of low concentrations of methanol (1 to 5 ppm). For CO, carbon dioxide and water may be interferants. In cases where COS levels are low relative to CO levels, CO and water may be interferants.

4.2 Sampling System Interferences.

Water, if it condenses, and ammonia, which reacts with formaldehyde.

5.0 Safety.

5.1 Formaldehyde is a suspect carcinogen; therefore, exposure to this compound must be limited. Proper monitoring and safety precautions must be practiced in any atmosphere with potentially high concentrations of CO.

5.2 This method may involve sampling at locations having high positive or negative pressures, high temperatures, elevated heights, high concentrations of hazardous or toxic pollutants, or other diverse sampling conditions. It is the responsibility of the tester(s) to ensure proper safety and health practices, and to determine the applicability of regulatory limitations before performing this test method.

6.0 Equipment and Supplies.

The equipment and supplies are based on the schematic of a sampling train shown in Figures 1 and 2. Either the evacuated or purged sampling technique may be used with this sampling train. Alternatives may be used, provided that the data quality objectives are met as determined in the post-analysis evaluation (see Section 13.0).

6.1 Sampling Probe. Glass, stainless steel, or other appropriate material of sufficient length and physical integrity to sustain heating, prevent adsorption of analytes, and to reach gas sampling point.

6.2 Particulate Filters. A glass wool plug (optional) inserted at the probe tip (for large particulate removal) and a filter rated at 1-micron (e.g., Balston™) for fine particulate removal, placed immediately after the heated probe.

6.3 Sampling Line/Heating System. Heated (sufficient to prevent sample condensation) stainless steel, Teflon, or other inert material that does not adsorb the analytes, to transport the sample to analytical system.

6.4 Stainless Steel Tubing. Type 316, e.g., 3/8 in. diameter, and appropriate length for heated connections.

6.5 Calibration/Analyte Spike Assembly. A three way valve assembly (or equivalent) to introduce methanol spikes into the sampling system at the outlet of the probe before the out-of-stack particulate filter and just before the FTIR analytical system. See Figure 1.

6.6 Mass Flow Meters. To accurately measure analyte spiking flow rate, calibrated from 0 to 2 L/min (± 2 percent).

6.7 Gas Regulators. Appropriate for individual gas cylinders.

6.8 Teflon Tubing. Diameter (e.g., 3/8 in.) and length suitable to connect cylinder regulators.

6.9 Sample Pump. A leak-free pump (e.g., KNFT™), with by-pass valve, capable of pulling sample through entire sampling system at a rate of about 10 to 20 L/min. If placed before the analytical system, heat the pump and use a pump fabricated from materials non-reactive to the target pollutants. If the pump is located after the instrument, systematically record the sample pressure in the gas cell.

6.10 Gas Sample Manifold. A heated manifold that diverts part of the sample stream to the analyzer, and the rest to the by-pass discharge vent or other analytical instrumentation.

6.11 Rotameter. A calibrated 0 to 20 L/min range rotameter.

6.12 FTIR Analytical System. Spectrometer and detector, capable of measuring formaldehyde, phenol, methanol, COS and CO to the predetermined minimum detectable level. The system shall include a

personal computer with compatible software that provides real-time updates of the spectral profile during sample collection and spectral collection.

6.13 FTIR Cell Pump. Required for the evacuated sampling technique, capable of evacuating the FTIR cell volume within 2 minutes. The FTIR cell pump should allow the operator to obtain at least 8 sample spectra in 1 hour.

6.14 Absolute Pressure Gauge. Heatable and capable of measuring pressure from 0 to 1000 mmHg to within ± 2.5 mmHg (e.g., Baratron™).

6.15 Temperature Gauge. Capable of measuring the cell temperature to within $\pm 2^\circ\text{C}$.

7.0 Reagents and Standards.

7.1 Methanol/Sulfur Hexafluoride. Obtain a gas cylinder mixture of 100 ppm methanol and 2 ppm SF₆ in N₂. This gas mixture need not be certified.

7.2 Ethylene (Calibration Transfer Standard). Obtain NIST traceable (or Protocol) cylinder gas.

7.3 Nitrogen. Ultra high purity (UHP) grade.

7.4 Reference Spectra. Obtain reference spectra for the target pollutants at concentrations that bracket (in "ppm-meter/K") the emission source levels. Also, obtain reference spectra for SF₆ and ethylene. Suitable concentrations are 0.0112 to 0.112 (ppm-meter)/K for SF₆ and 5.61 (ppm-meter)/K or less for ethylene. The reference spectra shall meet the criteria for acceptance outlined in Section 2.2.2.

8.0 Sample Collection, Preservation, and Storage.

Sampling should be performed in the following sequence: Collect background, collect CTS spectrum, QA spiking and direct-to-cell measurement of spike gas, collect samples, post-test QA spiking and direct-to-cell measurement, collect post-test CTS spectrum, verify that two copies of all data were stored on separate computer media.

8.1 Pretest Preparations and Evaluations. Using the procedure in Section 4.0 of the FTIR Protocol, determine the optimum sampling system configuration for sampling the target pollutants. Table 2 gives some example values for AU, DL, and MAU. Based on a study (Reference 1), an FTIR system using 1 cm⁻¹ resolution, 22 meter path length, and a broad band MCT detector was suitable for meeting the requirements in Table 2. Other factors that must be determined are:

a. Test requirements: AU_i, CMAX_i, DL_i, OFU_i, and t_{AN} for each.

b. Interferants: See Table 1.

c. Sampling system: L_S', P_S', T_S', t_{SS}, V_{SS}; fractional error, MIL.

d. Analytical regions: 1 through N_m, FL_m, FC_m, and FU_m, plus interferants, FFU_m, FFL_m, wavenumber range FNU to FNL. See Tables 1 and 2.

8.1.1 If necessary, sample and acquire an initial spectrum. Then determine the proper operational pathlength of the instrument to obtain non-saturated absorbencies of the target analytes.

8.1.2 Set up the sampling train as shown in Figure 1.

8.2 Sampling System Leak-check. Leak-check from the probe tip to pump outlet as

follows: Connect a 0 to 250-mL/min rate meter (rotameter or bubble meter) to the outlet of the pump. Close off the inlet to the probe, and note the leakage rate. The leakage rate shall be ≤ 200 mL/min.

8.3 Analytical System Leak-check.

8.3.1 For the evacuated sample technique, close the valve to the FTIR cell, and evacuate the absorption cell to the minimum absolute pressure P_{\min} . Close the valve to the pump, and determine the change in pressure ΔP_v after 2 minutes.

8.3.2 For both the evacuated sample and purging techniques, pressurize the system to about 100 mmHg above atmospheric pressure. Isolate the pump and determine the change in pressure ΔP_p after 2 minutes.

8.3.3 Measure the barometric pressure, P_b in mmHg.

8.3.4 Determine the percent leak volume $\%V_L$ for the signal integration time t_{ss} and for ΔP_{\max} , i.e., the larger of ΔP_v or ΔP_p , as follows:

$$\%V_L = 50 t_{ss} \frac{\Delta P_{\max}}{P_{ss}} \quad (2)$$

Where:

50=100% divided by the leak-check time of 2 minutes.

8.3.5 Leak volumes in excess of 4 percent of the sample system volume V_{ss} are unacceptable.

8.4 Background Spectrum. Evacuate the gas cell to ≤ 5 mmHg, and fill with dry nitrogen gas to ambient pressure. Verify that no significant amounts of absorbing species (for example water vapor and CO_2) are present. Collect a background spectrum, using a signal averaging period equal to or greater than the averaging period for the sample spectra. Assign a unique file name to the background spectrum. Store the spectra of the background interferogram and processed single-beam background spectrum on two separate computer media (one is used as the back-up).

8.5 Pre-Test Calibration Transfer Standard. Evacuate the gas cell to ≤ 5 mmHg absolute pressure, and fill the FTIR cell to atmospheric pressure with the CTS gas. Or, purge the cell with 10 cell volumes of CTS gas. Record the spectrum.

8.6 Samples.

8.6.1 Evacuated Samples. Evacuate the absorbance cell to ≤ 5 mmHg absolute pressure before. Fill the cell with flue gas to ambient pressure and record the spectrum. Before taking the next sample, evacuate the cell until no further evidence of absorption exists. Repeat this procedure to collect at least 8 separate spectra (samples) in 1 hour.

8.6.2 Purge Sampling. Purge the FTIR cell with 10 cell volumes of flue gas and at least for about 10 minutes. Discontinue the gas cell purge, isolate the cell, and record the sample spectrum and the pressure. Before taking the next sample, purge the cell with 10 cell volumes of flue gas.

8.6.3 Continuous Sampling. Spectra can be collected continuously while the FTIR cell is being purged. The sample integration time, t_{ss} , the sample flow rate through the FTIR gas cell, and the total run time must be chosen so that the collected data consist of at least

10 spectra with each spectrum being of a separate cell volume of flue gas. More spectra can be collected over the run time and the total run time (and number of spectra) can be extended as well.

8.7 Sampling QA, Data Storage and Reporting.

8.7.1 Sample integration times should be sufficient to achieve the required signal-to-noise ratios. Obtain an absorbance spectrum by filling the cell with nitrogen. Measure the RMSD in each analytical region in this absorbance spectrum. Verify that the number of scans is sufficient to achieve the target MAU (Table 2).

8.7.2 Identify all sample spectra with unique file names.

8.7.3 Store on two separate computer media a copy of sample interferograms and processed spectra.

8.7.4 For each sample spectrum, document the sampling conditions, the sampling time (while the cell was being filled), the time the spectrum was recorded, the instrumental conditions (path length, temperature, pressure, resolution, integration time), and the spectral file name. Keep a hard copy of these data sheets.

8.8 Signal Transmittance. While sampling, monitor the signal transmittance through the instrumental system. If signal transmittance (relative to the background) drops below 95 percent in any spectral region where the sample does not absorb infrared energy, obtain a new background spectrum.

8.9 Post-run CTS. After each sampling run, record another CTS spectrum.

8.10 Post-test QA.

8.10.1 Inspect the sample spectra immediately after the run to verify that the gas matrix composition was close to the expected (assumed) gas matrix.

8.10.2 Verify that the sampling and instrumental parameters were appropriate for the conditions encountered. For example, if the moisture is much greater than anticipated, it will be necessary to use a shorter path length or dilute the sample.

8.10.3 Compare the pre-and post-run CTS spectra. They shall agree to within ± 5 percent. See FTIR Protocol, Appendix E.

9.0 Quality Control.

Use analyte spiking to verify the validity of the sampling system for the analytes of interest. QA spiking shall be performed before the first run begins and again after the third run is completed. A direct-to-cell measurement of the spike gas should also be performed before and after sampling.

9.1 Spike Materials. Use Protocol or NIST traceable analyte gas standard, whenever possible. A vapor generation device may be used to prepare analyte spike from the neat or solid sample of formaldehyde and phenol (use this option only when certified cylinder gas standards cannot be obtained).

9.2 Spiking Procedure.

9.2.1 Introduce the spike/tracer gas at a constant (≤ 2 percent) flow rate ≤ 10 percent of the total sample flow.

(Note: Use the rotameter at the end of the sampling train to estimate the required spike/tracer gas flow rate.) Use a mass flow controller to control and monitor the flow rate of the spike/tracer gas.

9.2.2 Determine the response time (RT) by continuously monitoring effluent until

spike is equilibrated within the sampling/analytical system. Wait for a period of twice RT, then obtain at least two consecutive spectra of the spiked gas. Duplicate analyses of methanol and SF_6 shall be within ± 5 percent of their mean value.

9.2.3 Calculate the dilution ratio using the tracer gas as follows:

$$DF = \frac{SF_{6[dir]}}{SF_{6[spk]}} \quad (3)$$

where:

DF = Dilution factor of the spike gas; this value shall be ≥ 10 .

$SF_{6[dir]}$ = SF_6 concentration measured directly in undiluted spike gas.

$SF_{6[spk]}$ = Diluted SF_6 concentration measured in a spiked sample.

9.3 Bias. Determine the bias (defined by EPA Method 301, Section 6.3.1) as follows:

Calculate the expected analyte concentration in the spiked samples, CS:

$$CS = \frac{A_{i \text{ dir}}}{DF} \quad (4)$$

where:

$A_{i \text{ dir}}$ = Analyte concentration measured directly in undiluted spike gas.

DF = From equation 3.

$$B = S_m - M_m \left[1 - \frac{1}{DF} \right] - CS \quad (5)$$

where:

B = Bias at spike level.

S_m = Mean analyte concentration in the spiked samples.

M_m = Mean analyte concentration in the unspiked samples.

CS = Expected analyte concentration in the spiked samples.

DF = Dilution factor from Equation 3.

9.4 Correction Factor.

9.4.1 Calculate the correction factor, CF, using the following equation:

$$CF = \frac{1}{1 + \frac{B}{CS}} \quad (6)$$

9.4.2 If the CF is outside the range of 0.70 to 1.30, the data collected during the compliance test are unacceptable. For correction factors within the range, multiply all analytical results by the CF for that compound to obtain the final values.

10. Calibration and Standardization.

10.1 Signal-to-Noise Ratio (S/N). The S/N shall be sufficient to meet the MAU in each analytical region.

10.2 Absorbance Pathlength. Verify the absorbance path length by comparing CTS spectra to reference spectra of the calibration gas(es). See FTIR Protocol, Appendix E.

10.3 Instrument Resolution. Measure the line width of appropriate CTS band(s) and compare to reference CTS spectra to verify instrumental resolution.

10.4 Apodization Function. Choose appropriate apodization function. Determine any appropriate mathematical

transformations that are required to correct instrumental errors by measuring the CTS. Any mathematical transformations must be documented and reproducible.

10.5 **FTIR Cell Volume.** Evacuate the cell to ≤ 5 mmHg. Measure the initial absolute temperature (T_i) and absolute pressure (P_i). Connect a wet test meter (or a calibrated dry gas meter), and slowly draw room air into the cell. Measure the meter volume (V_m), meter absolute temperature (T_m), and meter absolute pressure (P_m), and the cell final absolute temperature (T_f) and absolute pressure (P_f). Calculate the FTIR cell volume V_{ss} , including that of the connecting tubing, as follows:

$$V_{ss} = \frac{V_m \frac{P_m}{T_m}}{\left[\frac{P_f}{T_f} - \frac{P_i}{T_i} \right]} \quad (7)$$

11. Procedure.

Refer to Sections 4.6–4.11, Sections 5, 6, and 7, and the appendices of the FTIR Protocol.

12.0 Data Analysis and Calculations.

a. Data analysis is performed using appropriate reference spectra whose concentrations can be verified using CTS spectra. Various analytical programs are available to relate sample absorbance to a

concentration standard. Calculated concentrations should be verified by analyzing spectral baselines after mathematically subtracting scaled reference spectra from the sample spectra. A full description of the data analysis and calculations may be found in the FTIR Protocol (Sections 4.0, 5.0, 6.0 and appendices).

b. Correct the calculated concentrations in sample spectra for differences in absorption pathlength between the reference and sample spectra by:

$$C_{corr} = \left[\frac{L_r}{L_s} \right] \left[\frac{T_s}{T_r} \right] C_{calc} \quad (8)$$

where:

C_{corr} = The pathlength corrected concentration.

C_{calc} = The initial calculated concentration (output of the Multicomp program designed for the compound).

L_r = The pathlength associated with the reference spectra.

L_s = The pathlength associated with the sample spectra.

T_s = The absolute temperature (K) of the sample gas.

T_r = The absolute gas temperature (K) at which reference spectra were recorded.

13. Reporting and Recordkeeping.

All interferograms used in determining source concentration shall be stored for the period of time required in the applicable regulation. The Administrator has the option of requesting the interferograms recorded during the test in electronic form as part of the test report.

14. Method Performance.

Refer to the FTIR Protocol. This method is self-validating provided that the results meet the performance specification of the QA spike in Section 9.0.

15. Pollution Prevention. [Reserved]

16. Waste Management.

Laboratory standards prepared from the formaldehyde and phenol are handled according to the instructions in the materials safety data sheets (MSDS).

17. References.

(1) "Field Validation Test Using Fourier Transform Infrared (FTIR) Spectrometry To Measure Formaldehyde, Phenol and Methanol at a Wool Fiberglass Production Facility." Draft. U.S. Environmental Protection Agency Report, Entropy, Inc., EPA Contract No. 68D20163, Work Assignment I-32, December 1994 (docket item II-A-13).

(2) "Method 301—Field Validation of Pollutant Measurement Methods from Various Waste Media," 40 CFR part 63, appendix A.

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