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Part II

Environmental Protection Agency

40 CFR Part 60, et al.

NESHAPS: Final Standards for Hazardous Air Pollutants for Hazardous Waste Combustors; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 60, 63, 260, 261, 264, 265, 266, 270, and 271

[FRL–6413–3]

RIN 2050–AEO1

NESHAPS: Final Standards for Hazardous Air Pollutants for Hazardous Waste Combustors

ACTION: Final rule.

SUMMARY: We are promulgating revised standards for hazardous waste incinerators, hazardous waste burning cement kilns, and hazardous waste burning lightweight aggregate kilns. These standards are being promulgated under joint authority of the Clean Air Act (CAA) and Resource Conservation and Recovery Act (RCRA). The standards limit emissions of chlorinated dioxins and furans, other toxic organic compounds, toxic metals, hydrochloric acid, chlorine gas, and particulate matter. These standards reflect the performance of Maximum Achievable Control Technologies (MACT) as specified by the Clean Air Act. These MACT standards also will result in increased protection to human health and the environment over existing RCRA standards.

DATES: This final rule is in effect on September 30, 1999. You are required to be in compliance with these promulgated standards 3 years following the effective date of the final rule (i.e., September 30, 2002). You are provided with the possibility of a site-specific one year extension for the installation of controls to comply with the final standards or for waste minimization reductions. The incorporation by reference of certain publications listed in the rule was approved by the Director of the Federal Register as of September 30, 1999.

ADDRESSES: The official record (*i.e.*, public docket) for this rulemaking is identified as Docket Numbers: F–96–RCSP–FFFFF, F–97–CS2A–FFFFF, F–97–CS3A–FFFFF, F–97–CS4A–FFFFF, F–97–CS5A–FFFFF, F–97–CS6A–FFFFF, F–98–RCSF–FFFFF, and F–1999–RC2F–FFFFF. The official record is located in the RCRA Information Center (RIC), located at Crystal Gateway One, 1235 Jefferson Davis Highway, First Floor, Arlington, Virginia. The mailing address for the official record is RCRA Information Center, Office of Solid Waste (5305W), U.S. Environmental Protection Agency Headquarters, 401 M Street, SW, Washington, DC 20460.

Public comments and supporting materials are available for viewing in the RIC. The RIC is open from 9 a.m. to 4 p.m., Monday through Friday, excluding federal holidays. To review docket materials, you must make an appointment by calling 703–603–9230 or by sending a message via e-mail to: RCRA-Docket@epamail.epa.gov. You may copy a maximum of 100 pages from any regulatory docket at no charge. Additional copies cost 15 cent/page. The index for the official record and some supporting materials are available electronically. See the ''Supplementary Information'' section of this **Federal Register** notice for information on accessing the index and these supporting materials.

FOR FURTHER INFORMATION CONTACT: For general information, you can contact the RCRA Hotline at 1–800–424–9346 or TDD 1–800–553–7672 (hearing impaired). In the Washington metropolitan area, call 703–412–9810 or TDD 703–412–3323. For additional information on the Hazardous Waste Combustion MACT rulemaking and to access available electronic documents, please go to our Web page: www.epa.gov/hwcmact. Any questions or comments on this rule can also be sent to EPA via our Web page.

For more detailed information on technical requirements of this rulemaking, you can contact Mr. David Hockey, 703–308–8846, electronic mail: Hockey.David@epamail.epa.gov. For more detailed information on permitting associated with this rulemaking, you can contact Ms. Patricia Buzzell, 703–308–8632, electronic mail: Buzzell.Tricia@epamail.epa.gov. For more detailed information on compliance issues associated with this rulemaking, you can contact Mr. Larry Gonzalez, 703–308–8468, electronic mail: Gonzalez.Larry@epamail.epa.gov. For more detailed information on the assessment of potential costs, benefits and other impacts associated with this rulemaking, you can contact Mr. Lyn Luben, 703–308–0508, electronic mail: Luben.Lyn@epamail.epa.gov. For more detailed information on risk analyses associated with this rulemaking, you can contact Mr. David Layland, 703–308–0482, electronic mail: Layland.David@epamail.epa.gov.

SUPPLEMENTARY INFORMATION:

Official Record. The official record is the paper record maintained at the address in **ADDRESSES** above. All comments that were received electronically were converted into paper form and placed in the official record, which also includes all comments submitted directly in writing. Our responses to comments, whether the comments are written or electronic, are located in the response to comments document in the official record for this rulemaking.

Supporting Materials Availability on the Internet. The index for the official record and the following supporting materials are available on the Internet as:

—Technical Support Documents for HWC MACT Standards:
  —Volume I: Description of Source Categories
  —Volume II: HWC Emissions Database
  —Volume III: Selection of MACT Standards and Technologies
  —Volume IV: Compliance with the MACT Standards
  —Volume V: Emission Estimates and Engineering Costs
—Assessment of the Potential Costs, Benefits and Other Impacts of the Hazardous Waste Combustion MACT Standards—Final Rule
—Risk Assessment Support to the Development of Technical Standards for Emissions from Combustion Units Burning Hazardous Wastes: Background Information Document
—Response to Comments for the HWC MACT Standards Document

To access the information electronically from the World Wide Web (WWW), type: *www.epa.gov/hwcmact*

Outline

Acronyms Used in the Rule

acfm—Actual cubic feet per minute
BIF—Boilers and industrial furnaces
CAA—Clean Air Act
CEMS—Continuous emissions monitors/monitoring system
CFR—Code of Federal Regulations
DOC—Documentation of Compliance
DRE—Destruction and Removal Efficiency
dscf—Dry standard cubic foot
dscm—Dry standard cubic meter
EPA/USEPA—United States Environmental Protection Agency
gr—Grains
HSWA—Hazardous and Solid Waste Amendments
kg—Kilogram
MACT—Maximum Achievable Control Technology
mg—Milligrams
Mg—Megagrams (metric tons)
NOC—Notification of Compliance
NESHAP—National Emission Standards for HAPs
ng—Nanograms
NODA—Notice of Data Availability
NPRM—Notice of Proposed Rulemaking
POHC—Principal Organic Hazardous Constituent

ppmv—Parts per million by volume
ppmw—Parts per million by weight
RCRA—Resource Conservation and Recovery Act
R & D—Research and Development
SSRA—Site specific risk assessment
TEQ—Toxicity equivalence
µg—Micrograms

Outline

Part One: Overview and Background for This Rule

I. What Is the Purpose of This Rule?

In this final rule, we adopt hallmark standards to more rigorously control toxic emissions from burning hazardous waste in incinerators, cement kilns, and lightweight aggregate kilns. These emission standards and continuation of our RCRA risk policy create a national cap for emissions that assures that combustion of hazardous waste in these devices is properly controlled.

The standards themselves implement section 112 of the Clean Air Act (CAA) and apply to the three major categories of hazardous waste burners—incinerators, cement kilns, and lightweight aggregate kilns. For purposes of today's rule, we refer to these three categories collectively as hazardous waste combustors. Hazardous waste combustors burn about 80% of the hazardous waste combusted annually within the United States. As a result, we project that today's standards will achieve highly significant reductions in the amount of hazardous air pollutants being emitted each year by hazardous waste combustors. For example, we estimate that 70 percent of the annual dioxin and furan emissions from hazardous waste combustors will be eliminated. Mercury emissions already controlled to some degree under existing regulations will be further reduced by about 55 percent.

Section 112 of the CAA requires emissions standards for hazardous air pollutants to be based on the performance of the Maximum Achievable Control Technology (MACT). The emission standards in this final rule are commonly referred to as MACT standards because we use the MACT concept to determine the levels of emission control under section 112(d) of the CAA.[1] At the same time, these emissions standards satisfy our obligation under the main statute regulating hazardous waste management, the Resource Conservation Recovery Act (RCRA), to ensure that hazardous waste combustion is conducted in a manner adequately protective of human health and the environment. Our use of both authorities as the legal basis for today's rule and details of the MACT standard-setting process are explained more fully in later sections of this preamble. Most significantly, by using both authorities in a harmonized fashion, we consolidate regulatory control of hazardous waste combustion into a single set of regulations, thereby eliminating the potential for conflicting or duplicative federal requirements.

Today's rule also has other important features in terms of our legal obligations and public commitments. First, promulgation of these standards fulfills our legal obligations under the CAA to control emissions of hazardous air pollutants from hazardous-waste burning incinerators and Portland cement kilns.[2] Second, today's rule fulfills our 1993 and 1994 public commitments to upgrade emission standards for hazardous waste combustors. These commitments are the centerpiece of our Hazardous Waste Minimization and Combustion Strategy.[3] Finally, today's rulemaking satisfies key terms of a litigation settlement agreement entered into in 1993 with a number of groups that had challenged our previous rule addressing emissions from hazardous waste boilers and industrial furnaces.[4]

II. In Brief, What Are the Major Features of Today's Rule?

The major features of today's final rule are summarized below.

A. Which Source Categories Are Affected by This Rule?

This rule establishes MACT standards for three source categories, namely: Hazardous waste burning incinerators, hazardous waste burning cement kilns, and hazardous waste burning lightweight aggregate kilns. As mentioned earlier, we refer to these three source categories collectively as hazardous waste combustors.

B. How Are Area Sources Affected by This Rule?

This rule establishes that MACT standards apply to both major sources—sources that emit or have the potential to emit 10 tons or greater per year of any single hazardous air pollutant or 25 tons per year or greater of hazardous air pollutants in the aggregate—and area sources, all others. Area sources may be regulated under MACT standards if we find that the category of area sources ''presents a threat of adverse effects to human health or the environment * * * warranting regulation (under the MACT standards).'' We choose to regulate area sources in today's rule and, as a result, all hazardous waste burning incinerators, cement kilns, and lightweight aggregate kilns will be regulated under standards reflecting MACT.

C. What Emission Standards Are Established in This Rule?

This rule establishes emission standards for: Chlorinated dioxins and furans; mercury; particulate matter (as a surrogate for antimony, cobalt, manganese, nickel, and selenium); semivolatile metals (lead and cadmium); low volatile metals (arsenic, beryllium, and chromium); hydrogen chloride and chlorine gas (combined). This rule also establishes standards for carbon monoxide, hydrocarbons, and destruction and removal efficiency as surrogates in lieu of individual standards for nondioxin/furan organic hazardous air pollutants.

D. What Are the Procedures for Complying With This Rule?

This rule establishes standards that apply at all times (including during startup, shutdown, or malfunction), except if hazardous waste is not being burned or is not in the combustion chamber. When not burning hazardous waste (and when hazardous waste does not remain in the combustion chamber), you may either follow the hazardous waste burning standards in this rule or emission standards we promulgate, if any, for other relevant nonhazardous waste source categories.

Initial compliance is documented by stack performance testing. To document continued compliance with the carbon monoxide or hydrocarbon standards, you must use continuous emissions monitoring systems. For the remaining standards, you must document continued compliance by monitoring limits on specified operating parameters. These operating parameter

[1] The MACT standards reflect the ''maximum degree of reduction in emissions of * * * hazardous air pollutants'' that the Administrator determines is achievable, taking into account the cost of achieving such emission reduction and any nonair quality health and environmental impacts and energy requirements. Section 112(d)(2).

[2] In a 1992 **Federal Register** notice, we published the inital list of categories of major and area sources of hazardous air pollutants including hazardous waste incinerators and Portland cement plants. See 57 FR 31576 (July 16, 1992). Today's rule meets our obligation to issue MACT standards for hazardous waste incinerators. Today's rule also partially meets our obligation to issue MACT standards for Portland cement plants. To complete the obligation, we have finalized, in a separate rulemaking, MACT standards for the portland cement industry source category. Those standards apply to all cement kilns except those kilns that burn hazardous waste. See 64 FR 31898 (June 14, 1999). Those standards also apply to other HAP emitting sources at a cement plant (such as clinker coolers, raw mills, finish mills, and materials handling operations) regardless of whether the plant has hazardous waste burning cement kilns.

[3] EPA Document Number 530–R–94–044, Office of Solid Waste and Emergency Response, November 1994.

[4] ''Burning of Hazardous Waste in Boilers and Industrial Furnaces'' (56 FR 7134, February 21, 1991). These groups include the Natural Resources Defense Council, Sierra Club, Environmental Technology Council, National Solid Waste Management Association, and a number of local citizens' groups.

limits[5] are calculated based on performance test conditions using specified procedures intended to ensure that the operating conditions (and by correlation the actual emissions) do not exceed performance test levels at any time. You must also install an automatic waste feed cutoff system that immediately stops the flow of hazardous waste feed to the combustor if a continuous emissions monitoring system records a value exceeding the standard or if an operating parameter limit is exceeded (considering the averaging period for the standard or operating parameter). The standards and operating parameter limits apply when hazardous waste is being fed or remains in the combustion chamber irrespective of whether you institute the corrective measures prescribed in the startup, shutdown, and malfunction plan.

E. What Subsequent Performance Testing Must Be Performed?

You must conduct comprehensive performance testing every five years. This testing regime is referred to as ''subsequent performance testing.'' You must revise the operating parameter limits as necessary based on the levels achieved during the subsequent performance test. In addition, you must conduct confirmatory performance testing of dioxins/furans emissions under normal operating conditions midway between subsequent performance tests.

F. What Is the Time Line for Complying With This Rule?

The compliance date of the standards promulgated in today's rule is three years after the date of publication of the rule in the **Federal Register**, or September 30, 2002 (See CAA section 112(i)(3)(A) indicating that the Environmental Protection Agency (EPA) may establish a compliance date no later than three years from the date of promulgation.) A one-year extension of the compliance date may be requested if you cannot complete system retrofits by the compliance date despite a good faith effort to do so.[6] CAA section 112(i)(3)(B). Continuous emissions monitoring systems and other continuous monitoring systems for the specified operating parameters must be fully operational by the compliance date. You must demonstrate compliance by conducting a performance test no later than 6 months after the compliance date (i.e., three and one-half years from the date of publication of today's rule in the **Federal Register**).

To ensure timely compliance with the standards, by the compliance date you must place in the operating record a Documentation of Compliance identifying limits on the specified operating parameters you believe are necessary and sufficient to comply with the emission standards. These operating parameter limits (and the carbon monoxide or hydrocarbon standards monitored with continuous monitoring systems) are enforceable until you submit to the Administrator a Notification of Compliance within 90 days of completion of the performance test.

The Notification of Compliance must document: (1) Compliance with the emission standards during the performance test; (2) the revised operating parameter limits calculated from the performance test; and (3) conformance of the carbon monoxide or hydrocarbon continuous emissions monitoring systems and the other continuous monitoring systems with performance specifications. You must comply with the revised operating parameter limits upon submittal of the Notification of Compliance.

G. How Does This Rule Coordinate With the Existing RCRA Regulatory Program?

You must have a RCRA permit for stack air emissions (or RCRA interim status) until you demonstrate compliance with the MACT standards. You do so by conducting a comprehensive performance test and submitting a Notification of Compliance to the Administrator, as explained above.[7] Hazardous waste combustors with RCRA permits remain subject to RCRA stack air emission permit conditions until the RCRA permit is modified to delete those conditions. (As discussed later in more detail, we recommend requesting modification of the RCRA permit at the time you submit the Notification of Compliance.) Only those provisions of the RCRA permit that are less stringent than the MACT requirements specified in the Notification of Compliance will be approved for deletion.[8] Hazardous waste combustors still in interim status without a full RCRA permit are no longer subject to the RCRA stack air emissions standards for hazardous waste combustors in Subpart O of Part 265 and subpart H of part 266 once compliance with the MACT standards has been demonstrated and a Notification of Compliance has been submitted to the Administrator.

You must satisfy both sets of requirements during the relatively short period when both RCRA and MACT stack air emissions standards and associated requirements in the RCRA permit or in RCRA interim status regulations are effective.

You also may have existing site-specific permit conditions. On a case-by-case basis during RCRA permit issuance or renewal, we determine whether further regulatory control of emissions is needed to protect human health and the environment, notwithstanding compliance with existing regulatory standards. Additional conditions may be included in the permit in addition to those derived from the RCRA emission standards as necessary to ensure that facility operations are protective of human health and the environment. Any of these risk-based permit provisions more stringent than today's MACT standards (or that address other emission hazards) will remain in the RCRA permit.

After the MACT compliance date, hazardous waste combustors must continue to comply with the RCRA permit issuance process to address nonMACT provisions (*e.g.*, general facility standards) and potentially conduct a risk review under § 270.32(b)(2) to determine if additional requirements pertaining to stack or other emissions are warranted to ensure protection of human health and the environment.

III. What Is the Basis of Today's Rule?

As stated previously, this rule issues final National Emissions Standards for Hazardous Air Pollutants (NESHAPS) under authority of section 112 of the Clean Air Act for three source categories of combustors: Hazardous waste burning incinerators, hazardous waste burning cement kilns, and hazardous waste burning lightweight aggregate kilns. The main purposes of the CAA are to protect and enhance the quality of our Nation's

[5] The term ''operating parameter limit'' and ''operating limit'' have the same meaning and are used interchangeably in the preamble and rule language.

[6] In June 1998, we promulgated a rule to allow hazardous waste combustors also to request a one-year extension to the MACT compliance date in cases where additional time will be needed to install pollution prevention and waste minimization measures to significantly reduce the amount or toxicity of hazardous waste entering combustion feedstreams. See 63 FR at 43501 (June 19, 1998). This provision is recodified in today's rule as 40 CFR 63.1213.

[7] Hazardous waste combustors, of course, also continue to be subject to applicable RCRA requirements for all other aspects of their hazardous waste management activities that are separate from the requirements being deferred to the CAA by this rule.

[8] RCRA permit requirements that may be less stringent than applicable MACT standards are nonetheless enforceable until the RCRA permit is modified.

air resources, and to promote the public health and welfare and the productive capacity of the population. CAA section 101(b)(1). To this end, sections 112(a) and (d) of the CAA direct EPA to set standards for stationary sources emitting (or having the potential to emit) ten tons or greater of any one hazardous air pollutant or 25 tons or greater of total hazardous air pollutants annually. Such sources are referred to as ''major sources.''

Today's rule establishes MACT emission standards for the following hazardous air pollutants emitted by hazardous waste burning incinerators, hazardous waste burning cement kilns, and hazardous waste burning lightweight aggregate kilns: Chlorinated dioxins and furans, mercury, two semivolatile metals (lead and cadmium), three low volatility metals (arsenic, beryllium, and chromium), and hydrochloric acid/chlorine gas. This rule also establishes MACT control for the other hazardous air pollutants identified in CAA section 112(b)(1) through the adoption of standards using surrogates. For example, we adopt a standard for particulate matter as a surrogate to control five metals that do not have specific emission standards established in today's rule. These five metals are antimony, cobalt, manganese, nickel, and selenium. Also, we adopt standards for carbon monoxide, hydrocarbons, and destruction and removal efficiency to control the other organic hazardous air pollutants listed in section 112(b)(1) that do not have specific emission standards established in this rule.

Today's standards meet our commitment under the Hazardous Waste Minimization and Combustion Strategy, first announced in May 1993, to upgrade the emission standards for hazardous waste burning facilities. EPA's Strategy has eight goals: (1) Ensure public outreach and EPA-State coordination; (2) pursue aggressive use of waste minimization measures; (3) continue to ensure that combustion and alternative and innovative technologies are safe and effective; (4) develop and impose more rigorous controls on combustion facilities; (5) continue aggressive compliance and enforcement efforts; (6) enhance public involvement opportunities in the permitting process for combustion facilities; (7) give higher priority to permitting those facilities where a final permit decision would result in the greatest environmental benefit or the greatest reduction in risk; and (8) advance scientific understanding on combustion issues and risk assessment and ensure that permits are issued in a manner that provides proper protection of human health and the environment.

We have made significant progress in implementing the Strategy. Today's rule meets the Strategy goal of developing and implementing rigorous state-of-the-art safety controls on hazardous waste combustors by using the best available technologies and the most current science.[9] We also developed a software tool (*i.e.*, the Waste Minimization Prioritization Tool) that allows users to access relative persistent, bioaccumulative and toxic hazard scores for any of 2,900 chemicals that may be present in RCRA waste streams. We also committed to the reduction of the generation of the most persistent, bioaccumulative and toxic chemicals by 50 percent by 2005. To facilitate this reduction we are developing a list of the persistent, bioaccumulative and toxic chemicals of greatest concern and a plan for working with the regulated community to reduce these chemicals. In addition, we promulgated new requirements to enhance public involvement in the permitting process [10] and performed risk evaluations during the permitting process for high priority facilities. We also made allowances for one-year extensions to the MACT compliance period as incentives designed to promote the installation of cost-effective pollution prevention technologies to replace or supplement emission control technologies for meeting MACT standards.

Finally, with regard to the regulatory framework that will result from today's rule, we are eliminating the existing RCRA stack emissions national standards for hazardous waste incinerators, cement kilns, and lightweight aggregate kilns. That is, after submittal of the Notification of Compliance established by today's rule (and, where applicable, RCRA permit modifications at individual facilities), RCRA national stack emission standards will no longer apply to these hazardous waste combustors. We originally issued air emission standards under the authority of section 3004(a) of RCRA, which calls for EPA to promulgate standards ''as may be necessary to protect human health and the environment.'' In light of today's new MACT standards, we have determined that RCRA emissions standards for these sources would only be duplicative and so are no longer necessary to protect human health and the environment. Under the authority of section 3004(a), it is appropriate to eliminate such duplicative standards.

Emission standards for hazardous waste burning incinerators and other sources burning hazardous wastes as fuel must be protective of human health and the environment under RCRA. We conducted a multipathway risk assessment to assess the ecological and human health risks that are projected to occur under the MACT standards. We have concluded that the MACT standards are generally protective of human health and the environment and that separate RCRA emission standards are not needed. Please see a full discussion of the national assessment of exposures and risk in Part VIII of this preamble.

Additionally, RCRA section 1006(b) directs EPA to integrate the provisions of RCRA for purposes of administration and enforcement and to avoid duplication, to the maximum extent practicable, with the appropriate provisions of the Clean Air Act and other federal statutes. This integration must be done in a way that is consistent with the goals and policies of these statutes. Therefore, section 1006(b) provides further authority for EPA to eliminate the existing RCRA stack emissions standards to avoid duplication with the new MACT standards. Nevertheless, under the authority of RCRA's ''omnibus'' clause (section 3005(c)(3); see 40 CFR 270.32(b)(2)), RCRA permit writers may still impose additional terms and conditions on a site-specific basis as may be necessary to protect human health and the environment.

IV. What Was the Rulemaking Process for Development of This Rule?

We proposed MACT standards for hazardous waste burning incinerators, hazardous waste burning cement kilns, and hazardous waste burning lightweight aggregate kilns on April 19, 1996. (61 FR 17358) In addition, we published five notices of data availability (NODAs):

1. August 23, 1996 (61 FR 43501), inviting comment on information pertaining to a peer review of three aspects of the proposed rule and information pertaining to the since-promulgated ''Comparable Fuels'' rule (see 63 FR 43501 (June 19, 1998));

2. January 7, 1997 (62 FR 960), inviting comment on an updated hazardous waste combustor data base containing the emissions and ancillary

[9] The three source categories covered by today's final rule burn more than 80 percent of the total amount of hazardous waste being combusted each year. The remaining 15–20 percent is burned in industrial boilers and other types of industrial furnaces, which will be addressed in a future NESHAPS rulemaking for hazardous waste burning sources.

[10] See 60 FR 63417 (December 11, 1995).

data that the Agency used to develop the final rule;

3. March 21, 1997 (62 FR 13775), inviting comment on our approach to demonstrate the technical feasibility of monitoring particulate matter emissions from hazardous waste combustors using continuous emissions monitoring systems;

4. May 2, 1997 (62 FR 24212), inviting comment on several topics including the status of establishing MACT standards for hazardous waste combustors using a revised emissions data base and the status of various implementation issues, including compliance dates, compliance requirements, performance testing, and notification and reporting requirements; and

5. December 30, 1997 (62 FR 67788), inviting comment on several status reports pertaining to particulate matter continuous emissions monitoring systems.

Finally, we have had many formal and informal meetings with stakeholders, representing an on-going dialogue on various aspects of the rulemaking.

We carefully considered information and comments submitted by stakeholders on these rulemaking actions and during meetings. We address their comments in our Response to Comments documents, which can be found in the public docket supporting this rulemaking. In addition, we addressed certain significant comments at appropriate places in this preamble.

Part Two: Which Devices Are Subject to Regulation?

I. Hazardous Waste Incinerators

Hazardous waste incinerators are enclosed, controlled flame combustion devices, as defined in 40 CFR 260.10. These devices may be fixed or transportable. Major incinerator designs used in the United States are rotary kilns, fluidized beds, liquid injection and fixed hearth, while newer designs and technologies are also coming into operation. Detailed descriptions of the designs, types of facilities and typical air pollution control devices were presented in the April 1996 NPRM and in the technical background document prepared to support the NPRM. (See 61 FR 17361, April 19, 1996.) In 1997, there were 149 hazardous waste incinerator facilities operating 189 individual units in the U.S. Of these 149 facilities, 20 facilities (26 units) were commercial hazardous waste incinerators, while the remaining 129 facilities (163 units) were on-site hazardous waste incinerators.

II. Hazardous Waste Burning Cement Kilns

Cement kilns are horizontally inclined rotating cylinders, lined with refractory-brick, and internally fired. Cement kilns are designed to calcine, or drive carbon dioxide out of, a blend of raw materials such as limestone, shale, clay, or sand to produce Portland cement. When combined with sand, gravel, water, and other materials, Portland cement forms concrete, a material used widely in many building and construction applications.

Generally, there are two different processes used to produce Portland cement: a wet process and a dry process. In the wet process, raw materials are ground, wetted, and fed into the kiln as a slurry. In the dry process, raw materials are ground and fed dry into the kiln. Wet process kilns are typically longer in length than dry process kilns to facilitate water evaporation from the slurried raw material. Dry kilns use less energy (heat) and also can use preheaters or precalciners to begin the calcining process before the raw materials are fed into the kiln.

A number of cement kilns burn hazardous waste-derived fuels to replace some or all of normal fossil fuels such as coal. Most kilns burn liquid waste; however, cement kilns also may burn bulk solids and small containers containing viscous or solid hazardous waste fuels. Containers are introduced either at the upper, raw material end of the kiln or at the midpoint of the kiln.

All existing hazardous waste burning cement kilns use particulate matter control devices. These cement plants either use fabric filters (baghouses) or electrostatic precipitators to control particulate matter.

In 1997, there were 18 Portland cement plants operating 38 hazardous waste burning kilns. Of these 38 kilns, 27 kilns use the wet process to manufacture cement and 11 kilns use the dry process. Of the dry process kilns, one kiln uses a preheater and another kiln used a preheater and precalciner. Detailed descriptions of the design types of facilities and typical air pollution control devices are presented in the technical background document.[11]

In developing standards, the Agency considered the appropriateness of distinguishing among the different types of cement kilns burning hazardous waste. We determined that distinguishing subcategories of hazardous waste burning cement kilns was not needed to develop uniform, achievable MACT standards. (See Part Four, Section VII of the preamble for a discussion of subcategory considerations.)

III. Hazardous Waste Burning Lightweight Aggregate Kilns

The term ''lightweight aggregate'' refers to a wide variety of raw materials (such as clay, shale, or slate) that, after thermal processing, can be combined with cement to form concrete products. Lightweight aggregate concrete is produced either for structural purposes or for thermal insulation purposes. A lightweight aggregate plant is typically composed of a quarry, a raw material preparation area, a kiln, a cooler, and a product storage area. The material is taken from the quarry to the raw material preparation area and from there is fed into the rotary kiln.

A rotary kiln consists of a long steel cylinder, lined internally with refractory bricks, which is capable of rotating about its axis and is inclined horizontally. The prepared raw material is fed into the kiln at the higher end, while firing takes place at the lower end. As the raw material is heated, it melts into a semiplastic state and begins to generate gases that serve as the bloating or expanding agent. As temperatures reach their maximum, the semiplastic raw material becomes viscous and entraps the expanding gases. This bloating action produces small, unconnected gas cells, which remain in the material after it cools and solidifies. The product exits the kiln and enters a section of the process where it is cooled with cold air and then conveyed to the discharge. Kiln operating parameters such as flame temperature, excess air, feed size, material flow, and speed of rotation vary from plant to plant and are determined by the characteristics of the raw material.

In 1997, there were five lightweight aggregate kiln facilities in the United States operating 10 hazardous waste-fired kilns. Detailed descriptions of the lightweight aggregate process and air pollution control techniques are presented in the technical support document.[12]

[11] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume I: Description of Source Categories,'' July 1999.

[12] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume I: Description of Source Categories,'' July 1999.

Part Three: How Were the National Emission Standards for Hazardous Air Pollutants (NESHAP) in This Rule Determined?

I. What Authority Does EPA Have To Develop a NESHAP?

The 1990 Amendments to the Clean Air Act (CAA) significantly revised the requirements for controlling emissions of hazardous air pollutants. EPA is required to develop a list of categories of major and area sources of the hazardous air pollutants identified in section 112 and to develop, over specified time periods, technology-based performance standards for sources of these hazardous air pollutants. See CAA sections 112(c) and 112(d). These source categories and subcategories are to be listed pursuant to section 112(c)(1). We published an initial list of 174 categories of such major and area sources in the **Federal Register** on July 16, 1992 (57 FR 31576), which was later amended at 61 FR 28197 (June 4, 1996) [13] and 63 FR 7155 (February 12, 1998). That list includes the Hazardous Waste Incineration, Portland Cement Manufacturing, and Clay Products Manufacturing source categories.

Promulgation of technology-based standards for these listed source categories is not necessarily the final step in the process. CAA section 112(f) requires the Agency to report to Congress on the estimated risk remaining after imposition of technology-based standards and make recommendations as to additional legislation needed to address such risk. If Congress does not act on any recommendation presented in this report, we are required to impose additional controls if such controls are needed to protect public health with an ample margin of safety or (taking into account costs, energy, safety, and other relevant factors) to prevent adverse environmental effects. In addition, if the technology-based standards for carcinogens do not reduce the lifetime excess cancer risk for the most exposed individual to less than one in a million (1×10^{-6}), then we must promulgate additional standards.

We prepared the Draft Residual Risk Report to Congress and announced its release on April 22, 1998 (63 FR 19914–19916). In that report, we did not propose any legislative recommendation to Congress. In section 4.2.4 of the report, we state that: ''The legislative strategy embodied in the 1990 CAA Amendments adequately maintains the goal of protecting the public health and the environment and provides a complete strategy for dealing with a variety of risk problems. The strategy recognizes that not all problems are national problems or have a single solution. National emission standards will be promulgated to decrease the emissions of as many hazardous air pollutants as possible from major sources.''

II. What Are the Procedures and Criteria for Development of NESHAPs?

A. Why Are NESHAPs Needed?

NESHAPs are developed to control hazardous air pollutant emissions from both new and existing sources. The statute requires a NESHAP to reflect the maximum degree of reduction of hazardous air pollutant emissions that is achievable taking into consideration the cost of achieving the emission reduction, any nonair quality health and environmental impacts, and energy requirements. NESHAPs are often referred to as maximum achievable control technology (or MACT) standards.

We are required to develop MACT emission standards based on performance of the best control technologies for categories or sub-categories of major sources of hazardous air pollutants. We also can establish lower thresholds for determining which sources are major where appropriate. In addition, we may require sources emitting particularly dangerous hazardous air pollutants such as particular dioxins and furans to control those pollutants under the MACT standards for major sources.

In addition, we regulate area sources by technology-based standards if we find that these sources (individually or in the aggregate) present a threat of adverse effects to human health or the environment warranting regulation. After such a determination, we have a further choice whether to require technology-based standards based on MACT or on generally achievable control technology.

B. What Is a MACT Floor?

The CAA directs EPA to establish minimum emission standards, usually referred to as MACT floors. For existing sources in a category or subcategory with 30 or more sources, the MACT floor cannot be less stringent than the ''average emission limitation achieved by the best performing 12 percent of the existing sources. * * *'' For existing sources in a category or subcategory with less than 30 sources, the MACT floor cannot be less stringent than the ''average emission limitation achieved by the best performing 5 sources. * * *'' For new sources, the MACT floor cannot be ''less stringent than the emission control that is achieved by the best controlled similar source. * * *''

We must consider in a NESHAP rulemaking whether to develop standards that are more stringent than the floor, which are referred to as ''beyond-the-floor'' standards. To do so, we must consider statutory criteria, such as the cost of achieving emission reduction, cost effectiveness, energy requirements, and nonair environmental implications.

Section 112(d)(2) specifies that 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); or (5) any combination of the above. See section 112(d)(2).

Application of techniques (1) and (2) are consistent with the definitions of pollution prevention under the Pollution Prevention Act and the definition of waste minimization under RCRA. In addition, these definitions are in harmony with our Hazardous Waste Minimization and Combustion Strategy. These terms have particular applicability in the discussion of pollution prevention/waste minimization incentives, which were finalized at 63 FR 33782 (June 19, 1998) and which are summarized in the permitting and compliance sections of this final rule.

C. How Are NESHAPs Developed?

To develop a NESHAP, we compile available information and in some cases collect additional information about the industry, including information on emission source quantities, types and characteristics of hazardous air pollutants, pollution control technologies, data from emissions tests (e.g., compliance tests, trial burn tests) at controlled and uncontrolled facilities, and information on the costs and other energy and environmental impacts of emission control techniques. We use this information in analyzing and developing possible regulatory

[13] A subsequent Notice was published on July 18, 1996 (61 FR 37542) which corrected typographical errors in the June 4, 1996 Notice.

approaches. Of course, we are not always able to assemble the same amount of information per industry and typically base the NESHAP on information practically available.

NESHAPs are normally structured in terms of numerical emission limits. However, alternative approaches are sometimes necessary and appropriate. Section 112(h) authorizes the Administrator to promulgate a design, equipment, work practice, or operational standard, or a standard that is a combination of these alternatives.

III. How Are Area Sources and Research, Development, and Demonstration Sources Treated in This Rule?

A. Positive Area Source Finding for Hazardous Waste Combustors

1. How Are Area Sources Treated in This Rule?

In today's final rule, we make a positive area source finding pursuant to CAA section 112(c)(3) for hazardous waste burning incinerators, hazardous waste burning cement kilns, and hazardous waste burning lightweight aggregate kilns. This rule subjects both major and area sources in these three source categories to the same standards—the section 112(d) MACT standards. We make this positive area source determination because emissions from area sources subject to today's rule present a threat of adverse effects to human health and the environment. These threats warrant regulation under the section 112 MACT standards.

2. What Is an Area Source?

Area sources are sources emitting (or having the potential to emit) less than 10 tons per year of an individual hazardous air pollutant, and less than 25 tons per year of hazardous air pollutants in the aggregate. These sources may be regulated under MACT standards if we find that the sources ''presen[t] a threat of adverse effects to human health or the environment (by such sources individually or in the aggregate) warranting regulation under this section.'' Section 112(c)(3).

As part of our analysis, we estimate that all hazardous waste burning lightweight aggregate kilns are major sources, principally due to their hydrochloric acid emissions. We also estimate that approximately 80 percent of hazardous waste burning cement kilns are major sources, again due to hydrochloric acid emissions. Only approximately 30 percent of hazardous waste burning incinerators appear to be major sources, considering only the stack emissions from the incinerator. However, major and area source status is determined by the entire facility's hazardous air pollutant emissions, so that many on-site hazardous waste incinerators are major sources because they are but one contributing source of emissions among others (sometimes many others at large manufacturing complexes) at the same facility.

3. What Is the Basis for Today's Positive Area Source Finding?

The consequences of us not making a positive area source finding in this rule would result in an undesirable bifurcated regulation. First, the CAA provides independent authority to regulate certain hazardous air pollutant emissions under MACT standards, even if the emissions are from area sources. These are the hazardous air pollutants enumerated in section 112(c)(6), and include 2,3,7,8 dichlorobenzo-p-dioxins and furans, mercury, and some specific polycyclic organic hazardous air pollutants—hazardous air pollutants regulated under this rule. See 62 FR at 24213–24214. Thus, all sources covered by today's rule would have to control these hazardous air pollutants to MACT levels, even if we were not to make a positive area source determination. Second, because all hazardous air pollutants are fully regulated under RCRA, area source hazardous waste combustors would have not only a full RCRA permit, but also (as just explained) a CAA title V permit for the section 112(c)(6) hazardous air pollutants. One purpose of this rule is to avoid the administrative burden to sources resulting from this type of dual permitting, and these burdensome consequences of not making a positive area source finding have influenced our decision that area source hazardous waste combustors ''warrant regulation'' under section 112(d)(2).

a. Health and Environmental Factors. Our positive area source finding is based on the threats presented by emissions of hazardous air pollutants from area sources. We find that these threats warrant regulation under the MACT standards given the evident Congressional intent for uniform regulation of hazardous waste combustion sources, as well as the common emission characteristics of these sources and amenability to the same emission control mechanisms.

As discussed in both the April 1996 proposal and May 1997 NODA, all hazardous waste combustion sources, including those that may be area sources, have the potential to pose a threat of adverse effects to human health or the environment, although some commenters disagree with this point. These sources emit some of the most toxic, bioaccumulative and persistent hazardous air pollutants—among them dioxins, furans, mercury, and organic hazardous air pollutants. As discussed in these **Federal Register** notices and elsewhere in today's final rule, potential hazardous waste combustor area sources can be significant contributors to national emissions of these hazardous air pollutants. (See 62 FR 17365 and 62 FR 24213.)

Our positive area source finding also is based on the threat posed by products of incomplete combustion. The risks posed by these hazardous air pollutants cannot be directly quantified on a national basis, because each unit emits different products of incomplete combustion in different concentrations. However, among the products of incomplete combustion emitted from these sources are potential carcinogens.[14] The potential threat posed by emissions of these hazardous air pollutants is manifest and, for several reasons, we do not believe that control of these products of incomplete combustion should be left to the RCRA omnibus permitting process. First, we are minimizing the administrative burden on sources from duplicative permitting in this rule by minimizing the extent of RCRA permitting and hence minimizing our reliance on the omnibus process. Second, we are dealing with hazardous air pollutant emissions from these sources on a national rather than a case-by-case basis. We conclude that the control of products of incomplete combustion from all hazardous waste combustors through state-of-the art organic pollution control is the best way to do so from an implementation standpoint. Finally, a basic premise of the CAA is that there are so many uncertainties and difficulties in developing effective risk-based regulation of hazardous air pollutants that the first step should be technology-based standards based on Maximum Available Control Technology. See generally S. Rep. No. 228, 101st Cong. 1st Sess. 128–32 (1990). The positive area source finding and consequent MACT controls is consistent with this primary legislative objective.

The quantitative risk assessment for the final rule did not find risk from

[14] *E.g.*, benzene, methylene chloride, hexachlorobenzene, carbon tetrachloride, vinal chloride, benzo(a)pyrene, and chlorinated dioxins and furans. Energy and Environmental Research Corp., surrogate Evaluation for Thermal Treatment Systems, Draft Report, October 1994. Also see: USEPA, ''Final technical Support Document for HWC MACT Standards, Volume III: Section of MACT Standards and Technologies,'' July 1999.

mercury emissions from hazardous waste burning area source cement kilns to be above levels we generally consider acceptable. However, the uncertainties underlying the analysis are such that only qualitative judgments can be made. We do not believe our analysis can be relied upon to make a definitive quantitative finding about the precise magnitude of the risk. See Part Five, Section XIII for a discussion of uncertainty. Background exposures, which can be quite variable, were not considered in the quantitative assessment and are likely to increase the risk from incremental exposures to mercury from area source cement kilns. Commenters, on the other hand, believed that cement kilns did not pose significant risk and questioned our risk estimates made in the April 1996 NPRM and May 1997 NODA. However, taking into account the uncertainty of our mercury analysis and the likelihood of background exposures, a potential for risk from mercury may exist. Furthermore, the information available concerning the adverse human health effects of mercury, along with the magnitude of the emissions of mercury from area source cement kilns, also indicate that a threat of adverse effects is presumptive and that a positive area source finding is warranted.

b. Other Reasons Warranting Regulation under Section 112. Other special factors indicate that MACT standards are warranted for these sources.

The first reason is Congress's, our, and the public's strong preference for similar, if not identical, regulation of all hazardous waste combustors. Area sources are currently regulated uniformly under RCRA, with no distinction being made between smaller and larger emitters. This same desire for uniformity is reflected in the CAA. CAA section 112(n)(7) directs the Agency, in its regulation of HWCs under RCRA, to ''take into account any regulations of such emissions which are promulgated under such subtitle (*i.e.*, RCRA) and shall, to the maximum extent practicable and consistent with the provisions of this section, ensure that the requirements of such subtitle and this section are consistent.'' Congress also dealt with these sources as a single class by excluding hazardous waste combustion units regulated by RCRA permits from regulation as municipal waste combustors under CAA section 129(g)(1). Thus, a strong framework in both statutes indicates that air emissions from all hazardous waste combustors should be regulated under a uniform approach. Failure to adopt such a uniform approach would therefore be inconsistent with Congressional intent as expressed in both the language and the structure of RCRA and the CAA. Although many disagree, several commenters support the approach to apply uniform regulations for all hazardous waste combustors and assert that it is therefore appropriate and necessary to make the positive area source finding.

Second, a significant number of hazardous waste combustors could plausibly qualify as area sources by the compliance date through emissions reductions of one or more less dangerous hazardous air pollutants, such as total chlorine. We conclude it would be inappropriate to exclude from CAA 112(d) regulation and title V permitting a significant portion of the sources contributing to hazardous air pollutant emissions, particularly nondioxin products of incomplete combustion should this occur.

Third, the MACT controls identified for major sources are reasonable and appropriate for potential area sources. The emissions control equipment (and where applicable, feedrate control) defined as floor or beyond-the-floor control for each source category is appropriate and can be installed and operated at potential area sources. There is nothing unique about the types and concentrations of emissions of hazardous air pollutants from any class of hazardous waste combustors that would make MACT controls inappropriate for that particular class of hazardous waste combustors, but not the others. Commenters also raised the issue of applying generally available control technologies (GACT), in lieu of MACT, to area sources. Consideration of GACT lead us to the conclusion that GACT would likely involve the same types and levels of control as we identified for MACT. We believe GACT would be the same as MACT because the standards of this rule, based on MACT, are readily achievable, and therefore would also be determined to be generally achievable, *i.e.*, GACT.

Finally, we note that the determination here is unique to these RCRA sources, and should not be viewed as precedential for other CAA sources. In the language of the statute, there are special reasons that these RCRA sources warrant regulation under section 112(d)(2)—and so warrant a positive area source finding—that are not present for usual CAA sources. These reasons are discussed above—the Congressional desire for uniform regulation and our desire (consistent with this Congressional objective) to avoid duplicative permitting of these sources wherever possible. We repeat, however, that the positive area source determination here is not meant as a precedent outside the dual RCRA/CAA context.

B. How Are Research, Development, and Demonstration (RD&D) Sources Treated in This Rule?

Today's rule excludes research, development, and demonstration sources from the hazardous waste burning incinerator, cement kiln, and lightweight aggregate kiln source categories. We discuss below the statutory mandate to give special consideration to research and development (R&D) sources, an Advanced Notice of Proposed Rulemaking to list R&D facilities that we published in 1997, and qualifications for exclusion of R&D sources from the hazardous waste combustor source categories.

1. Why Does the CAA Give Special Consideration to Research and Development (R&D) Sources?

Section 112(c)(7) of the Clean Air Act requires EPA to ''establish a separate category covering research or laboratory facilities, as necessary to assure the equitable treatment of such facilities.'' Congress included such language in the Act because it was concerned that research and laboratory facilities should not arbitrarily be included in regulations that cover manufacturing operations. The Act defines a research or laboratory facility as ''any stationary source whose primary purpose is to conduct research and development into new processes and products, where such source is operated under the close supervision of technically trained personnel and is not engaged in the manufacture of products for commercial sale in commerce, except in a *de minimis* manner.''

We interpret the Act as requiring the listing of R&D major sources as a separate category to ensure equitable treatment of such facilities. Language in the Act specifying special treatment of R&D facilities (section 112(c)(7)), along with language in the legislative history of the Act, suggests that Congress considered it inequitable to subject the R&D facilities of an industry to a standard designed for the commercial production processes of that industry. The application of such a standard may be inappropriate because the wide range of operations and sizes of R&D facilities. Further, the frequent changes in R&D operations may be significantly different from the typically large and continuous production processes.

We have no information indicating that there are R&D sources, major or

area, that are required to be listed and regulated, other than those associated with sources already included in listed source categories listed today. Although we are not aware of other R&D sources that need to be added to the source category list, such sources may exist, and we requested information about them in an Advance Notice of Proposed Rulemaking, as discussed in the next section.

2. When Did EPA Notice Its Intent To List R&D Facilities?

In May 1997 (62 FR 25877), we provided advanced notice that we were considering whether to list R&D facilities. We requested public comments and information on the best way to list and regulate such sources. Comment letters were received from industry, academic representatives, and governmental entities. After we compile additional data, we will respond to these comments in that separate docket. As a result we are not deciding how to address the issue in today's rule. The summary of comments and responses will be one part of the basis for our future decision whether to list R&D facilities as a source category of hazardous air pollutants.

3. What Requirements Apply to Research, Development, and Demonstration Hazardous Waste Combustor Sources?

This rule excludes research, development, and demonstration sources from the hazardous waste incinerator, cement kiln, or lightweight aggregate kiln source categories and therefore from compliance with today's regulations. We are excluding research, development, and demonstration sources from those source categories because the emission standards and compliance assurance requirements for those source categories may not be appropriate. The operations and size of a research, development, and demonstration source may be significantly different from the typical hazardous waste incinerator that is providing ongoing waste treatment service or hazardous waste cement kiln or hazardous waste lightweight aggregate kiln that is producing a commercial product as well as providing ongoing waste treatment.

We also are applying the exclusion to demonstration sources because demonstration sources are operated more like research and development sources than production sources. Thus, the standards and requirements finalized today for production sources may not be appropriate for demonstration sources. Including demonstration sources in the exclusion is consistent with our current regulations for hazardous waste management facilities. See § 270.65 providing opportunity for special operating permits for research, development, and demonstration sources that use an innovative and experimental hazardous waste treatment technology or process.

To ensure that research, development, and demonstration sources are distinguished from production sources, we have drawn from the language in section 112(c)(7) to define a research, development, and demonstration source. Specifically, these are sources engaged in laboratory, pilot plant, or prototype demonstration operations: (1) Whose primary purpose is to conduct research, development, or short-term demonstration of an innovative and experimental hazardous waste treatment technology or process; and (2) where the operations are under the close supervision of technically-trained personnel.[15]

In addition, today's rule limits the exclusion to research, development, and demonstration sources that operate for not longer than one year after first processing hazardous waste, unless the Administrator grants a time extension based on documentation that additional time is needed to perform research development, and demonstration operations. We believe that this time restriction will help distinguish between research, development, and demonstration sources and production sources. This time restriction draws from the one-year time restriction (unless extended on a case-by-case basis) currently applicable to hazardous waste research, development, and demonstration sources under § 270.65.

The exclusion of research, development, and demonstration sources applies regardless of whether the sources are located at the same site as a production hazardous waste combustor that is subject to the MACT standards finalized today. A research, development, and demonstration source that is co-located at a site with a production source still qualifies for the exclusion. A research, development, and demonstration source co-located with a production source is nonetheless expected to experience the type and range of operations and be of the size typical for other research, development, and demonstration sources.

Finally, hazardous waste research, development, and demonstration sources remain subject to RCRA permit requirements under § 270.65, which direct the Administrator to establish permit terms and conditions that will assure protection of human health and the environment.

Although we did not propose this exclusion specifically for hazardous waste combustor research, development, and demonstration sources, the exclusion is an outgrowth of the May 1997 notice discussed above. In that notice we explain that we interpret the CAA as requiring the listing of research and development major sources as a separate category to ensure equitable treatment of such facilities. A commenter on the April 1996 hazardous waste combustor NPRM questioned whether we intended to apply the proposed regulations to research and development sources. We did not have that intent, and in response are finalizing today an exclusion of research, development, and demonstration sources from the hazardous waste incinerator, hazardous waste burning cement kiln, and hazardous waste burning lightweight aggregate kiln source categories.

IV. How Is RCRA's Site-Specific Risk Assessment Decision Process Impacted by This Rule?

RCRA Sections 3004(a) and (q) mandate that standards governing the operation of hazardous waste combustion facilities be protective of human health and the environment. To meet this mandate, we developed national combustion standards under RCRA, taking into account the potential risk posed by direct inhalation of the emissions from these sources.[16] With advancements in the assessment of risk since promulgation of the original national standards (*i.e.*, 1981 for incinerators and 1991 for boilers and industrial furnaces), we recognized in the 1993 Hazardous Waste Minimization and Combustion Strategy that additional risk analysis was appropriate. Specifically, we noted that the risk posed by indirect exposure (e.g., ingestion of contamination in the food chain) to long-term deposition of metals,

[15] The statute also qualifies that research and development sources do not engage in the manufacture of products for commercial sale except in a *de minimis* manner. Although this qualification is appropriate for research and development sources, engaged in short-term demonstration of an innovative or experimental treatment technology or process may produce products for use in commerce. For example, a cement kiln engaged in a short-term demonstration of an innovative process may nonetheless produce marketable clinker in other than *de minimis* quantities. Consequently, we are not including this qualification in the definition of a research, development, and demonstration source.

[16] See No CFR part 264, subpart O for incinerator standards and 40 CFR part 266, subpart H for BIF standards.

dioxin/furans and other organic compounds onto soils and surface waters should be assessed in addition to the risk posed by direct inhalation exposure to these contaminants. We also recognized that the national assessments performed in support of the original hazardous waste combustor standards did not take into account unique and site-specific considerations which might influence the risk posed by a particular source. Therefore, to ensure the RCRA mandate was met on a facility-specific level for all hazardous waste combustors, we strongly recommended in the Strategy that site-specific risk assessments (SSRAs), including evaluations of risk resulting from both direct and indirect exposure pathways, be conducted as part of the RCRA permitting process. In those situations where the results of a SSRA showed that a facility's operations could pose an unacceptable risk (even after compliance with the RCRA national regulatory standards), additional risk-based, site-specific permit conditions could be imposed pursuant to RCRA's omnibus authority (section 3005(c)(3)).

Today's MACT standards were developed pursuant to section 112(d) of the CAA, which does not require a concurrent risk evaluation of those standards. To determine if the MACT standards would satisfy the RCRA protectiveness mandate in addition to the requirements of the CAA, we conducted a national RCRA evaluation of both direct and indirect risk as part of this rulemaking. If we found the MACT standards to be sufficiently protective so as to meet the RCRA mandate as well, we could consider modifying our general recommendation that SSRAs be conducted for all hazardous waste combustors, thereby lessening the regulatory burden to both permitting authorities and facilities.

In this section, we discuss: The applicability of both the RCRA omnibus authority and the SSRA policy to hazardous waste combustors subject to today's rulemaking; the implementation of the SSRA policy; the relationship of the SSRA policy to the residual risk requirement of section 112(f) of the CAA; and public comments received on these topics. A discussion of the national risk characterization methodology and results is provided in Part Five, Section XIII of today's notice.

A. What Is the RCRA Omnibus Authority?

Section 3005(c)(3) of RCRA (codified at 40 CFR 270.32(b)(2)) requires that each hazardous waste facility permit contain the terms and conditions necessary to protect human health and the environment. This provision is commonly referred to as the ''omnibus authority'' or ''omnibus provision.'' It is the means by which additional site-specific permit conditions may be incorporated into RCRA permits should such conditions be necessary to protect human health and the environment.[17] SSRAs have come to be used by permitting authorities as a quantitative basis for making omnibus determinations for hazardous waste combustors.

In the April 1996 NPRM and May 1997 NODA, we discussed the RCRA omnibus provision and its relation to the new MACT standards. Commenters question whether the MACT standards supersede the omnibus authority with respect to hazardous waste combustor air emissions. Other commenters agree in principle with the continued applicability of the omnibus authority after promulgation of the MACT standards. These commenters recognize that there may be unique conditions at a given site that may warrant additional controls to those specified in today's notice. For those sources, the commenters acknowledge that permit writers must retain the legal authority to place additional operating limitations in a source's permit.

As noted above, the omnibus provision is a RCRA statutory requirement and does not have a CAA counterpart. The CAA does not override RCRA. Each statute continues to apply to hazardous waste combustors unless we determine there is duplication and use the RCRA section 1006(b) deferral authority to create a specific regulatory exemption.[18] Promulgation of the MACT standards, therefore, does not duplicate, supersede, or otherwise modify the omnibus provision or its applicability to sources subject to today's rulemaking. As indicated in the April 1996 NPRM, a RCRA permitting authority (such as a state agency) has the responsibility to supplement the national MACT standards as necessary, on a site-specific basis, to ensure adequate protection under RCRA. We recognize that this could result in a situation in which a source may be subject to emission standards and operating conditions under two regulatory authorities (*i.e.*, CAA and RCRA). Although our intent, consistent with the integration provision of RCRA section 1006(b), is to avoid regulatory duplication to the maximum extent practicable, we may not eliminate RCRA requirements if a source's emissions are not protective of human health and the environment when complying with the MACT standards.[19]

B. How Will the SSPA Policy Be Applied and Implemented in Light of This Mandate?

1. Is There a Continuing Need for Site-Specific Risk Assessments?

As stated previously, EPA's Hazardous Waste Minimization and Combustion Strategy recommended that SSRAs be conducted as part of the RCRA permitting process for hazardous waste combustors where necessary to protect human health and the environment. We intended to reevaluate this policy once the national hazardous waste combustion standards had been updated. We view today's MACT standards as more stringent than those earlier standards for incinerators, cement kilns and lightweight aggregate kilns. To determine if the MACT standards as proposed in the April 1996 NPRM would satisfy the RCRA mandate to protect human health and the environment, we conducted a national evaluation of both human health and ecological risk. That evaluation, however, did not quantitatively assess the proposed standards with respect to mercury and nondioxin products of incomplete combustion. This was due to a lack of adequate information regarding the behavior of mercury in the environment and a lack of sufficient emissions data and parameter values (*e.g.*, bioaccumulation values) for nondioxin products of incomplete combustion. Since it was not possible to suitably evaluate the proposed standards for the potential risk posed by mercury and nondioxin products of incomplete combustion, we elected in the April 1996 NPRM to continue recommending that SSRAs be conducted as part of the permitting process until we could conduct a further assessment once final MACT standards are promulgated and implemented.

Although some commenters agree with this approach, a number of other commenters question the necessity of a quantitative nondioxin product of incomplete combustion assessment to demonstrate RCRA protectiveness of the MACT standards. These commenters

[17] The risk-based permit conditions are in addition to those conditions required by the RCRA national regulatory standards for hazardous waste combustors (*e.g.*, general facility requirements).

[18] The risk-based permit conditions are in addition to those conditions required by the RCRA national regulatory standards for hazardous waste combustors (*e.g.*, general facility requirements).

[19] RCRA section 1006(b) authorizes deferral of RCRA provisions to other EPA-implemented authorities provided, among other things, that key RCRA policies and protections are not sacrificed. See *Chemical Waste Management* v. *EPA*, 976 F. 2d 2, 23, 25 (D.C. Cir. 1992).

assert that existing site-specific assessments demonstrate that emissions of nondioxin products of incomplete combustion are unlikely to produce significant adverse human health effects. However, we do not agree that sufficient SSRA information exists to conclude that emissions from these compounds are unlikely to produce significant adverse effects on human health and the environment on a national basis. First, only a limited number of completed SSRAs are available from which broader conclusions can be drawn. Second, nondioxin products of incomplete combustion emissions can vary widely depending on the type of combustion unit, hazardous waste feed and air pollution control device used. Third, a significant amount of uncertainty exists with respect to identifying and quantifying these compounds. Many nondioxin products of incomplete combustion cannot be characterized by standard analytical methodologies and are unaccounted for by standard emissions testing.[20] (On a site-specific basis, uncharacterized nondioxin products of incomplete combustion are typically addressed by evaluating the total organic emissions.) Fourth, nondioxin products of incomplete combustion can significantly contribute to the overall risk posed by a particular facility. For example, in the Waste Technologies Industries incinerator's SSRA, nondioxin organics were estimated to contribute approximately 30% of the total cancer risk to the most sensitive receptor located in the nearest subarea to the facility.[21] Fifth, national risk management decisions concerning the protectiveness of the MACT standards must be based on data that are representative of the hazardous waste combustors subject to today's rulemaking. We do not believe that the information afforded by the limited number of SSRAs now available is sufficiently complete or representative to render a national decision.[22]

Some commenters recommend discontinuing conducting SSRAs altogether. Other commenters, however, advocate continuing to conduct SSRAs, where warranted, as a means of addressing uncertainties inherent in the national risk evaluation and of addressing unique, site-specific circumstances not considered in the assessment.

In developing the national risk assessment for the final MAC standards, we expanded our original analysis to include a quantitative assessment of mercury patterned after the recently published Mercury Study Report to Congress.[23] We were unable to perform a similar assessment of nondioxin products of incomplete combustion emissions because of continuing data limitations for these compounds, despite efforts to collect additional data since publication of the April 1996 NPRM . Thus, we conclude that sufficient data are not available to quantitatively assess the potential risk from these constituents on a national level as part of today's rulemaking.

Given the results of the final national risk assessment for other hazardous air pollutants, we generally anticipate that sources complying with the MACT standards will not pose an unacceptable risk to human health or the environment. However, we cannot make a definitive finding in this regard for all hazardous waste combustors subject to today's MACT standards for the reasons discussed.

First, as discussed above, the national risk evaluation did not include an assessment of the risk posed by nondioxin products of incomplete combustion. As reflected in the Waste Technologies Industries SSRA, these compounds can significantly contribute to the overall risk posed by a hazardous waste combustor. Without a quantitative evaluation of these compounds, we cannot reliably predict whether the additional risk contributed by nondioxin products of incomplete combustion would or would not result in an unacceptable increase in the overall risk posed by hazardous waste combustors nationally.

Second, the quantitative mercury risk analysis conducted for today's rulemaking contains significant uncertainties. These uncertainties limit the use of the analysis for drawing quantitative conclusions regarding the risks associated with the national mercury MACT standard. Among others, the uncertainties include an incomplete understanding of the fate and transport of mercury in the environment and the biological significance of exposures to mercury in fish. (See Part Five, Section XIII.) Given these uncertainties, we believe that conducting a SSRA, which will assist a permit writer to reduce uncertainty on a site-specific basis, may be still warranted in some cases.[24] As the science regarding mercury fate and transport in the environment and exposure improves, and greater certainty is achieved in the future, we may be in a better position from which to draw national risk management conclusions regarding mercury risk.

Third, we agree with commenters who indicated that, by its very nature, the national risk assessment, while comprehensive, cannot address unique, site-specific risk considerations.[25] As a result of these considerations, a separate analysis or ''risk check'' may be necessary to verify that the MACT standards will be adequately protective under RCRA for a given hazardous waste combustor.

Thus, we are recommending that for hazardous waste combustors subject to the Phase I final MACT standards, permitting authorities should evaluate the need for a SSRA on a case-by-case basis.[26] SSRAs are not anticipated to be necessary for every facility, but should be conducted for facilities where there is some reason to believe that operation

[20] USEPA, ''Development of a Hazardous Waste Incinerator Target Analyte List of Products of Incomplete Combustion'' EPA–600/R–98–076. 1998.

[21] The total cancer risk for this receptor was 1 x 10E–6. The results derived for the Waste Technologies Industries incinerator's SSRA are a combination of measurements and conservative estimates of stack and fugitive emissions, which were developed in tandem with an independent external peer review. USEPA, ''Risk Assessment for the Waste Technologies Industries Hazardous Waste Incineration Facility (East Livepool, Ohio)'' EPA–905–R97–002.

[22] Since publication of the April 1996 NPRM, we have expanded our national risk evaluation of the other hazardous waste combustor emissions (*e.g.*, metals) from 11 facilities to 76 facilities assessed for today's final rulemaking. The 76 facilities were selected using a stratified random sampling approach that allowed for a 90 percent probability of including at least one ''high risk'' facility. However, this larger set of facility assessments does not include an evaluation nondioxin products of incomplete combustion. See Part Five, Section XIII for further discussion.

[23] USEPA, ''Mercury Study Report to Congress, Volume III: Fate and Transport of Mercury in the Environment,'' EPA 452/R–97–005, December 1997.

[24] An example of the possible reduction in uncertainty which may be derived through the performance of a SSRA includes the degree of conversion of mercury to methyl mercury in water bodies. Due to the wide range of chemical and physical properties associated with surface water bodies, there appears to be a great deal of variability concerning mercury methylation. In conducting a SSRA, a risk assessor may choose to use a default value to represent the percentage of mercury assumed to convert to methyl mercury. Conversely, the risk assessor may choose to reduce the uncertainty in the analysis by deriving a site-specific value using actual surface water data. Chemical and physical properties that may influence mercury methylation include, but are not limited to: dissolved oxygen content, pH, dissolved organic content, salinity, nutrient concentrations, and temperature. See USEPA, ''Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities,'' EPA–530–D–98–001A, External Peer Review Draft, 1998.

[25] Including for example, unusual terrain or dispersion features, particularly sensitive ecosystems, unusually high contaminant background concentrations, and mercury methylation rates in surface water.

[26] We continue to recommend that for those HWCs not subject to the Phase I final MACT standards, as SSRA should be conducted as part of the RCRA permitting process.

in accordance with the MACT standards alone may not be protective of human health and the environment. If a SSRA does demonstrate that operation in accordance with the MACT standards may not be protective of human health and the environment, permitting authorities may require additional conditions as necessary. We consider this an appropriate course of action to ensure protection of human health and the environment under RCRA, given current limits to our scientific knowledge and risk assessment tools.

2. How Will the SSRA Policy Be Implemented?

Some commenters suggest that EPA provide regulatory language specifically requiring SSRAs. Adequate authority and direction already exists to require SSRAs on a case-by-case basis through current regulations and guidance (none of which are being reconsidered, revised or otherwise reopened in today's rulemaking). The omnibus provision (codified in 40 CFR 270.32(b)(2)) directs the RCRA permitting authority to include terms and conditions in the RCRA permit as necessary to ensure protection of human health and the environment. Under 40 CFR 270.10(k), the permitting authority may require a permittee or permit applicant to submit information where the permitting authority has reason to believe that additional permit conditions may be warranted under § 270.32(b)(2). Performance of a SSRA is a primary, although not exclusive mechanism by which the permitting authority may develop the information necessary to make the determination regarding what, if any, additional permit conditions are needed for a particular hazardous waste combustor. Thus, for hazardous waste combustors, the information required to establish permit conditions could include a SSRA, or the necessary information required to conduct a SSRA.

In 1994, we provided guidance concerning the appropriate methodologies for conducting hazardous waste combustor SSRAs.[27] This guidance was updated in 1998 and released for publication as an external peer review draft.[28] We anticipate that use of the updated and more detailed guidance will result in a more standardized assessments for hazardous waste combustors.

To implement the RCRA SSRA policy, we expect permitting authorities to continue evaluating the need for an individual hazardous waste combustor risk assessment on a case-by-case basis. We provided a list of qualitative guiding factors in the April 1996 NPRM to assist in this determination. One commenter is concerned that the subjectivity inherent in the list of guiding factors might lead to inconsistencies when determining if a SSRA is necessary and suggested that we provide additional guidance on how the factors should be used. We continue to believe that the factors provided, although qualitative, generally are relevant to the risk potential of hazardous waste combustors and therefore should be considered when deciding whether or not a SSRA is necessary. However, as a practical matter, the complexity of the multipathway risk assessment methodology precludes conversion of these qualitative factors into more definitive criteria. We will continue to compile data from SSRAs to determine if there are any trends which would assist in developing more quantitative or objective criteria for deciding on the need for a SSRA at any given site. In the interim, SSRAs provide the most credible basis for comparisons between risk-based emission limits and the MACT standards.

The commenter further suggests that EPA emphasize that the factors should be considered collectively due to their complex interplay (*e.g.*, exposure is dependent on fate and transport which is dependent on facility characteristics, terrain, meteorological conditions, etc.). We agree with the commenter. The elements comprising multipathway risk assessments are highly integrated. Thus, the considerations used in determining if a SSRA is necessary are similarly interconnected and should be evaluated collectively.

The guiding factors as presented in the April 1996 NPRM contained several references to the proposed MACT standards. As a result, we modified and updated the list to reflect promulgation of the final standards and to re-focus the factors to specifically address the types of considerations inherent in determining if a SSRA is necessary. The revised guiding factors are: (1) Particular site-specific considerations such as proximity to receptors, unique dispersion patterns, *etc.;* (2) identities and quantities of nondioxin products of incomplete combustion most likely to be emitted and to pose significant risk based on known toxicities (confirmation of which should be made through emissions testing); (3) presence or absence of other off-site sources of pollutants in sufficient proximity so as to significantly influence interpretation of a facility-specific risk assessment; (4) presence or absence of significant ecological considerations, such as high background levels of a particular contaminant or proximity of a particularly sensitive ecological area; (5) volume and types of wastes being burned, for example wastes containing highly toxic constituents both from an acute and chronic perspective; (6) proximity of schools, hospitals, nursing homes, day care centers, parks, community activity centers that would indicate the presence of potentially sensitive receptors; (7) presence or absence of other on-site sources of hazardous air pollutants so as to significantly influence interpretation of the risk posed by the operation of the source in question; and (8) concerns raised by the public. The above list of qualitative guiding factors is not intended to be all-inclusive; we recognize that there may be other factors equally relevant to the decision of whether or not a SSRA is warranted in particular situations.

With respect to existing hazardous waste combustion sources, we do not anticipate a large number of SSRAs will need to be performed after the compliance date of the MACT standards. SSRAs already have been initiated for many of these sources. We strongly encourage facilities and permitting authorities to ensure that the majority of those risk assessments planned or currently in progress be completed prior to the compliance date of the MACT standards. The results of these assessments can be used to provide a numerical baseline for emission limits. This baseline then can be compared to the MACT limits to determine if site-specific risk-based limits are appropriate in addition to the MACT limits for a particular source.

Several commenters suggest that completed risk assessments should not have to be repeated. We do not anticipate repeating many risk assessments. It should be emphasized that changes to comply with the MACT standards should not cause an increase in risk for the vast majority of the facilities given that the changes, in all probability, will be the addition of pollution control equipment or a reduction in the hazardous waste being burned. For those few situations in which the MACT requirements might result in increased potential risk for a particular facility due to unique site-specific considerations, the RCRA permit writer, however, may determine

[27] USEPA. ''Guidance for Performing Screening Level Risk Analyses at Combustion Facilities Burning Hazardous Wastes'' Draft, April 1994; USEPA. ''Implementation of Exposure Assessment Guidance for RCRA Hazardous Waste Combustion Facilities'' Draft, 1994.

[28] USEPA. ''Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities'' EPA–520–D–98–001A, B&C. External Peer Review Draft, 1998.

that a risk check of the projected MACT emission rates is in order.[29] Should the results of the risk check demonstrate that compliance with the MACT requirements does not satisfy the RCRA protectiveness mandate, the permitting authority should invoke the omnibus provision to impose more stringent, site-specific, risk-based permit conditions as necessary to protect human health and the environment.

With respect to new hazardous waste combustors and existing combustors for which a SSRA has never been conducted, we recommend that the decision of whether or not a SSRA is necessary be made prior to the approval of the MACT comprehensive performance test protocol, thereby allowing for the collection of risk emission data at the same time as the MACT performance testing, if appropriate (see Part Five, Section V). In those instances where it has been determined a SSRA is appropriate, the assessment should take into account both the MACT standards and any relevant site-specific considerations.

We emphasize that the incorporation of site-specific, risk-based permit conditions into a permit is not anticipated to be necessary for the vast majority of hazardous waste combustors. Rather, such conditions would be necessary only if compliance with the MACT requirements is insufficient to protect human health and the environment pursuant to the RCRA mandate and if the resulting risk-based conditions are more stringent than those required under the CAA. Risk-based permit conditions could include, but are not limited to, more stringent emission limits, additional operating parameter limits, waste characterization and waste tracking requirements.

C. What Is the Difference Between the RCRA SSRA Policy and the CAA Residual Risk Requirement?

Section 112(f) of the CAA requires the Agency to conduct an evaluation of the risk remaining for a particular source category after compliance with the MACT standards. This evaluation of residual risk must occur within eight years of the promulgation of the MACT standards for each source category. If it is determined that the residual risk is unacceptable, we must impose additional controls on that source category to protect public health with an ample margin of safety and to prevent adverse environmental effects.

Our SSRA policy is intended to address the requirements of the RCRA protectiveness mandate, which are different from those provided in the CAA. For example, the omnibus provision of RCRA requires that the protectiveness determination be made on a permit-by-permit or site-specific basis. The CAA residual risk requirement, conversely, requires a determination be made on a source category basis. Further, the time frame under which the RCRA omnibus determination is made is more immediate; the SSRA is generally conducted prior to final permit issuance. The CAA residual risk determination, on the other hand, is made at any time within the eight-year time period after promulgation of the MACT standards for a source category. Thus, the possibility of a future section 112(f) residual risk determination does not relieve RCRA permit writers of the present obligation to determine whether the RCRA protectiveness requirement is satisfied. Finally, nothing in the RCRA national risk evaluation for this rule should be taken as establishing a precedent for the nature or scope of any residual risk procedure under the CAA.

Part Four: What Is the Rationale for Today's Final Standards?

I. Emissions Data and Information Data Base

A. How Did We Develop the Data Base for This Rule?

To support the emissions standards in today's rule, we use a ''fourth generation'' data base that considers and incorporates public comments on previous versions of the data base. This final data base [24] summarizes emissions data and ancillary information on hazardous waste combustors that was primarily extracted from incinerator trial burn reports and cement and lightweight aggregate kiln Certification of Compliance test reports prepared as part of the compliance process for the current regulatory standards. Ancillary information in the data base includes general facility information (*e.g.*, location) process operating data (*e.g.*, waste, fuel, raw material compositions, feed rates), and facility equipment design and operational information (*e.g.*, air pollution control device temperatures).

The data base supporting the April 1996 proposal was the initial data base released for public comment.[25] We received a substantial number of public comments on this data base including identification of data errors and submission of many new trial burn and compliance test reports not already in the data base. Subsequently, we developed a ''second generation'' data base addressing these comments and, on January 7, 1997, published a NODA soliciting public comment on the updated data base. Numerous industry stakeholders submitted comments on the second generation data base. The data base was revised again to accommodate these public comments resulting in a ''third generation'' data base. We also published for comment a document indicating how specific public comments submitted in response to the January NODA were addressed.[26] In the May 1997 NODA, we used this third generation data base to re-evaluate the MACT standards. Since the completion of the third generation data base, we have incorporated additional data base comments and new test reports resulting in the ''fourth generation'' data base. This final data base is used to support all MACT analyses discussed in today's rule. Compared to the changes made to develop the third generation data base, those changes made in the fourth generation are relatively minor. The majority of these changes (e.g., incorporating a few trial burn reports and incorporating suggested revisions to the third generation data base) were in response to public comments received to May 1997 NODA.

B. How Are Data Quality and Data Handling Issues Addressed?

We selected approaches to resolve several data quality and handling issues regarding: (1) Data from sources no longer burning hazardous waste; (2) assigning values to reported nondetect measurements; (3) data generated under normal conditions versus worst-case compliance conditions; and (4) use of imputation techniques to fill in missing or unavailable data. This section discusses our selected approaches to these four issues.

[29] For example, hazardous waste burning cement kilns that previously monitored hydrocarbons in the main stack may elect to install a mid-kiln sampling port for carbon monoxide or hydrocarbon monitoring to avoid restrictions on hydrocarbon levels in the main stack. Thus, their stack hydrocarbon emissions may increase.

[24] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume II: HWC Emissions Database,'' July 1999.

[25] USEPA, ''Draft Technical Support Document for HWC MACT Standards, Volume II: HWC Emissions Database,'' February 1996.

[26] See USEPA, ''Draft Report of Revisions to Hazardous Waste Combustor Database Based on Public Comments Submitted in Response to the January 7, 1997 Notice of Data Availability (NODA),'' May 1997.

1. How Are Data From Sources No Longer Burning Hazardous Waste Handled?

Data and information from sources no longer burning hazardous waste are not considered in the MACT standards evaluations promulgated today. We note that some facilities have recently announced plans to cease burning hazardous waste. Because we cannot continually adjust our data base and still finalize this rulemaking, we concluded revisions to the data base in early 1998. Announcements or actual facility changes after that date simply could not be incorporated.

Numerous commenters responded to our request for comment on the appropriate approach to handle emissions data from sources no longer burning hazardous waste. In the April 1996 proposal, we considered all available data, including data from sources that had since ceased waste burning operations. However, in response to comments to the April 1996 NPRM, in the May 1997 NODA we excluded data from sources no longer burning hazardous waste and reevaluated the MACT floors with the revised data base. Of the data included in the fourth generation data base, the number of sources that have ceased waste burning operations include 18 incineration facilities comprising 18 sources; eight cement kiln facilities comprising 12 sources; and one lightweight aggregate kiln facility comprising one source.

Several commenters support the inclusion in the MACT analyses of data from sources no longer burning hazardous waste. They believe the performance data from these sources are representative of emissions control achievable when burning hazardous waste because the data were generated under compliance testing conditions. Other commenters suggest that data from sources no longer burning hazardous waste should be excluded from consideration when conducting MACT floor analyses to ensure that the identified MACT floor levels are achievable.

The approach we adopt today is identical to the one we used for the May 1997 NODA. Rather than becoming embroiled in a controversy over continued achievability of the MACT standards, we exercise our discretion and use a data base consisting of only facilities now operating (at least as of the data base finalization date). Ample data exist to support setting the MACT standards without using data from facilities that no longer burn hazardous waste. To the extent that some previous data from facilities not now burning hazardous waste still remain in the data base, we ascribe to the view that these data are representative of achievable emissions control and can be used.

2. How Are Nondetect Data Handled?

In today's rule, as in the May 1997 NODA, we evaluated nondetect values, extracted from compliance test reports and typically associated with feedstream input measurements rather than emissions concentrations, as concentrations that are present at one-half the detection limit. In the proposal, we assumed that nondetect analyses were present at the value of the full detection limit.

Some commenters support our approach to assume that nondetect values are present at one-half the detection limit. The commenter states that this approach is consistent with the data analysis techniques used in other EPA environmental programs such as in the evaluation of groundwater monitoring data. Other commenters oppose treating nondetect values at one-half the detection limit, especially for dioxins/furans because Method 23 for quantitating stack emissions states that nondetect values for congeners be treated as zero when calculating total congeners and the toxicity equivalence quotient for dioxins/furans. As explained in the NODA, the assumption that nondetect measurements are present at one-half the reported detection limit is more technically and environmentally conservative and increases our confidence that standards and risk findings are appropriate. Further, we considered assuming that nondetect values were present at the full detection limit, but found that there were no significant differences in the MACT data analysis results.[27] Therefore, in today's rule, we assume nondetect measurements are present at one-half the detection limit.

3. How Are Normal Versus Worst-Case Emissions Data Handled?

The majority of the available emissions data for all of the hazardous air pollutants except mercury can be considered worst-case because they were generated during RCRA compliance testing. Because limits on operating parameters are established based on compliance test operations, sources generally operate during compliance testing under worst-case conditions to account for variability in operations and emissions. However, the data base also contains some normal data for these hazardous air pollutants. Normal data include those where hazardous waste was burned, but neither spiking of the hazardous waste with metals or chlorine nor operation of the combustion unit and emission control equipment under detuned conditions occurred.

In the MACT analyses supporting today's rule, normal data were not used to identify or define MACT floor control, with the exception of mercury, as discussed below. This approach is identical to the one used in the May 1997 NODA. 62 FR 24216.

Several commenters support the use of normal emissions data in defining MACT controls because the effect of ignoring the potentially lower emitters from these sources would skew the analysis to higher floor results. Other commenters oppose the use of normal data because they would not be representative of emissions under compliance test conditions—the conditions these same sources will need to operate under during MACT performance tests to establish limits on operating conditions.[28]

We conclude that it is inappropriate to perform the MACT floor analysis for a particular hazardous air pollutant using emissions data that are a mixture of normal and worst-case data. The few normal emissions data would tend to dominate the identification of best performing sources while not necessarily being representative of the range of normal emissions. Because the vast majority of our data is based on worst-case compliance testing, the definition of floor control is based on worst-case data.[29] Using worst-case emissions data to establish a MACT

[27] Using dioxins and furans as an example, for those sources using MACT control, this difference is no more than approximately 10 percent of the standard. USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

[28] These commenters are concerned that, if the standards were based on normal emissions data, sources would be inappropriately constrained to emissions that are well below what is currently normal. This is because of the double ratcheting effect of the compliance regime whereby a source must first operate below the standard during compliance testing, and then again operate below compliance testing levels (and associated operating parameters) to maintain day-to-day compliance.

[29] We considered adjusting the emissions data to account for spiking to develop a projected normal emissions data base. However, we conclude that this is problematic and have not done so. For example, it is difficult to project (lower) emissions from semivolatile metal-spiked emissions data given that system removal efficiency does not correlate linearly with semivolatile metal feedrate. In addition, we did not know for certain whether some data were spiked. Thus, we would have to use either a truncated data base of despiked data or a mixed data base of potentially spiked data and despiked data, neither of which would be fully satisfactory.

floor also helps account for emissions variability, as discussed in Section V.D. below.

Sources did not generally spike mercury emissions during RCRA compliance testing because they normally feed mercury at levels resulting in emissions well below current limits.[30] Consequently, sources are generally complying with generic, conservative feedrate limits established under RCRA rather than feedrate limits established during compliance testing. Because our data base is comprised essentially of normal emissions, we believe this is one instance where use of normal data to identify MACT floor is appropriate. See discussion in Section V.D. below of how emissions variability is addressed for the mercury floors.

4. What Approach Was Used To Fill In Missing or Unavailable Data?

With respect to today's rule, the term ''imputation'' refers to a data handling technique where a value is filled-in for a missing or unavailable data point. We only applied this technique to hazardous air pollutants that are comprised of more than one pollutant (*i.e.*, semivolatile metals, low volatile metals, total chlorine). We used imputation techniques in both the proposal and May 1997 NODA; however, we decided not to use imputation procedures in the development of today's promulgated standards. We used only complete data sets in our MACT determinations. Several commenters to the proposal and May 1997 NODA oppose the use of imputation techniques. Commenters express concern that the imputation approach used in the proposal did not preserve the statistical characteristics (average and standard deviation) of the entire data set. Thus, commenters suggest that subsequent MACT analyses were flawed. We reevaluated the data base and determined that a sufficient number of data sets are complete without the use of an imputation technique.[31] A complete discussion of various data handling conventions is presented in the technical support document.[32]

II. How Did We Select the Pollutants Regulated by This Rule?

Section 112(b) of the Clean Air Act, as amended, provides a list of 188[33] hazardous air pollutants for which the Administrator must promulgate emission standards for designated major and area sources. The list is comprised of metal, organic, and inorganic compounds.

Hazardous waste combustors emit many of the hazardous air pollutants. In particular, hazardous waste combustors can emit high levels of dioxins and furans, mercury, lead, chromium, antimony, and hydrogen chloride. In addition, hazardous waste combustors can emit a wide range of nondioxin/furan organic hazardous air pollutants, including benzene, chloroform, and methylene chloride.

In today's rule, we establish nine emission standards to control hazardous air pollutants emitted by hazardous waste combustors. Specifically, we establish emission standards for the following hazardous air pollutants: Chlorinated dioxins and furans, mercury, two semivolatile metals (*i.e.*, lead and cadmium), three low volatility metals (*i.e.*, arsenic, beryllium, chromium), and hydrochloric acid/chlorine gas. In addition, MACT control is provided for other hazardous air pollutants via standards for surrogates: (1) A standard for particulate matter will control five metal hazardous air pollutants—antimony, cobalt, manganese, nickel, and selenium; and (2) standards for carbon monoxide, hydrocarbons, and destruction and removal efficiency will control nondioxin/furan organic hazardous air pollutants.

A. Which Toxic Metals Are Regulated by This Rule?[34]

1. Semivolatile and Low Volatile Metals

The Section 112(b) list of hazardous air pollutants includes 11 metals: antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, and selenium. To establish an implementable approach for controlling these metal hazardous air pollutants, we proposed to group the metals by their relative volatility and established emission standards for each volatility group. We placed six of the eleven metals in volatility groups. The high-volatile group is comprised of mercury, the semivolatile group is comprised of lead and cadmium, and the low volatile group is comprised of arsenic, beryllium, and chromium.[35] We refer to these six metals for which we have established standards based on volatility group as ''enumerated metals.'' We have chosen to control the remaining five metals using particulate matter as a surrogate as discussed in the next section.

Grouping metals by volatility is reasonable given that emission control strategies are governed primarily by a metal's volatility. For example, while semivolatile metals and low volatile metals are in particulate form in the emission control train and can be removed as particulate matter, mercury species are generally emitted from hazardous waste combustors in the vapor phase and cannot be controlled by controlling particulate matter unless a sorbent, such as activated carbon, is injected into the combustion gas. In addition, low volatile metals are easier to control than semivolatile metals because semivolatile metals volatilize in the combustion chamber and condense on fine particulate matter, which is somewhat more difficult to control. Low volatile metals do not volatilize significantly in hazardous waste combustors and are emitted as larger, easier to remove, particles entrained in the combustion gas.[36]

Commenters agree with our proposal to group metals by their relative volatility. We adopt these groupings for the final rule.

We note that the final rule does not require a source to control its particulate matter below the particulate matter standard to control semivolatile and low

[30] Three of 23 incinerators used to define MACT floor (*i.e.*, sources for which mercury feedrate data are available) are known to have spiked mercury. No cement kilns used to define MACT floor (*e.g.*, excluding sources that have stopped burning hazardous waste) are known to have spiked mercury. Only one of ten lightweight aggregate kilns used to define MACT floor is known to have spiked mercury.

[31] This is especially true because antimony is no longer included in the low volatile metal standard.

[32] See USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

[33] The initial list consisted of 189 HAPs, but we have removed caprolactam (CAS number 105602) from the list of hazardous air pollutants. See § 63.60.

[34] RCRA standards currently control emissions of three toxic metals that have not been designated as Clean Air Act hazardous air pollutants: Barium, silver, and thallium. These RCRA metals are incidentally controlled by today's MACT controls for metal hazardous air pollutants in two ways. First, the RCRA metals are semivolatile or nonvolatile and will, in part, be controlled by the air pollution control systems used to meet the semivolatile metal and low volatile metal standards in today's rule. Second, these RCRA metals will be controlled by the measures used to meet today's MACT participate matter standard. See text that follows.

[35] Antimony was included in the low volatile group at proposal, but we subsequently determined that the MACT particulate matter standard serves as an adequate surrogate for this metal. See the May 1997 NODA (62 FR at 24216). In making this determination, we noted that antimony is an noncarcinogen with relatively low toxicity compared with the other five nonmercury metals that were placed in volatility groups. To be of particular concern, antimony would have to be present in hazardous waste at several orders of magnitude higher than shown in the available data.

[36] The dynamics associated with the fate of metals in a hazardous waste combustor are much more complex than presented here. For more information, see USEPA, ''Draft Technical Support Document for HWC MACT Standards, Volume VII: Miscellaneous Technical Issues,'' February 1996.

volatile metals. It is true that when we were determining the semivolatile and low volatile metal floor standards, we did examine the feedrates from only those facilities that were meeting the numerical particulate standard. See Part Four, Section V.B.2.c. This is because we believe that facilities, in practice, use both feedrate and particulate matter air pollution control devices in a complementary manner to address metals emissions (except mercury). However, our setting of the semivolatile and low volatile metal floor standards does not require MACT particulate matter control to be installed, either directly or indirectly, as a matter of CAA compliance. We do not think it is necessary to require compliance with a particulate matter standard as an additional express element of the semivolatile/low volatile metal emission standards because the particulate matter standard is already required to control the nonenumerated metals, as discussed below. However, we could have required compliance with a particulate matter standard as part of the semivolatile or low volatile metal emission standard because of the practice of using particulate matter control as at least part of a facility's strategy to control or minimize metal emissions (other than mercury).

2. How Are the Five Other Metal Hazardous Air Pollutants Regulated?

We did not include five metal hazardous air pollutants (*i.e.*, antimony, cobalt, manganese, nickel, selenium) in the volatility groups because of: (1) Inadequate emissions data for these metals [37]; (2) relatively low toxicity of antimony, cobalt, and manganese; and (3) the ability to achieve control, as explained below, by means of surrogates. Instead, we chose the particulate matter standard as a surrogate control for antimony, cobalt, manganese, nickel, and selenium. We refer to these five metals as ''nonenumerated metals'' because standards specific to each metal have not been established. We conclude that emissions of these metals is effectively controlled by the same air pollution control devices and systems used to control particulate matter.

Some commenters suggest that particulate matter is not a surrogate for the five nonenumerated metals. Commenters also note that our own study, as well as investigations by commenters, did not show a relationship between particulate matter and semivolatile metals and low volatile metals when emissions from multiple sources were considered. However, we conclude that such a relationship is not expected when multiple sources are considered because wide variations in source operations can affect: (1) Metals and particulate matter loadings at the inlet to the particulate matter control device; (2) metals and particulate matter collection efficiency; and (3) metals and particulate matter emissions. Factors that can contribute to variability in source operations include metal feed rates, ash levels, waste types and physical properties (*i.e.*, liquid vs. solid), combustion temperatures, and particulate matter device design, operation, and maintenance.

Conversely, emissions of semivolatile metals and low volatile metals are directly related to emissions of particulate matter at a given source when other operating conditions are held constant (*i.e.*, as particulate matter emissions increase, emissions of these metals also increase) because semivolatile metals and low volatile metals are present as particulate matter at the typical air pollution control device temperatures of 200 to 400°F that are required under today's rule.[38] A strong relationship between particulate matter and semivolatile/low volatile metal emissions is evident from our emissions data base of trial burn emissions at individual sources where particulate matter varies and metals feedrates and other conditions that may affect metals emissions were held fairly constant. Other work also has clearly demonstrated that improvement in particulate control leads to improved metals control.[39]

We also requested comment on whether particulate matter could be used as a surrogate for all semivolatile and low volatile metal hazardous air pollutants (*i.e.*, all metal hazardous air pollutants except mercury). See the May 1997 NODA. This approach is strongly recommended by the cement industry. In that Notice, we concluded that, because of varying and high levels of metals concentrations in hazardous waste, use of particulate matter control alone may not provide MACT control for metal hazardous air pollutants.[40] Our conclusion is the same today. Without metal-specific MACT emission standards or MACT feedrate standards, sources could feed high levels of one or more metal hazardous air pollutant metals. This practice could result in high metal emissions, even though the source's particulate matter is controlled to the emission standard (*i.e.*, a large fraction of emitted particulate matter could be comprised of metal hazardous air pollutants). Thus, the use of particulate matter control alone would not constitute MACT control of that metal and would be particularly troublesome for the enumerated semivolatile and low volatile metal because of their toxicity.[41]

Many commenters suggest that particulate matter is an adequate surrogate for all metal hazardous air pollutants. They suggest that, given current metal feedrates and emission rates, particularly in the cement industry, a particulate matter standard is sufficient to ensure that metal hazardous air pollutants (other than mercury) are controlled to levels that would not pose a risk to human health or the environment. While this may be true in some cases as a theoretical matter, it may not be in all cases. Data demonstrating this conclusively were not available for all cement kilns. Moreover, this approach may not ensure MACT control of the potentially problematic (*i.e.*, high potential risk) metals for reasons discussed above (*i.e.*, higher metal feedrates will result in higher metals emissions even though particulate matter capture efficiency remains constant). Consequently, we conclude that semi-volatile metals and low volatile metals standards are appropriate in addition to the particulate matter standard.

Finally, several commenters suggest that a particulate matter standard is not needed to control the five nonenumerated metals because the standards for the enumerated semivolatile and low volatile metals would serve as surrogates for those

[37] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume II: HWC Emissions Database,'' July 1999.

[38] The dioxin/furan emission standard requires that gas temperatures at the inlet to electrostatic precipitators and fabric filters not exceed 400°F. Wet particulate matter control devices reduce gas temperatures to below 400°F by virtue of their design and operation. The vapor phase contribution (*i.e.*, nonparticulate form that will not be controlled by a particulate matter control device) of semivolatile metal and low volatile metal at these temperatures is negligible.

[39] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

[40] However, for sources not burning hazardous waste and without a significant potential for extreme variability in metals feedrates, particulate matter is an adequate surrogate for metal hazardous air pollutants (*e.g.*, for nonhazardous waste burning cement kilns).

[41] Using particulate matter as a surrogate for metals is, however, the approach we used in the final rule for five metals: Antimony, cobalt, manganese, nickel, selenium. Technical and practical reasons unique to these metals support this approach. First, these metals exhibit relatively low toxicity. Second, for some of these metals, we did not have emissions data adequate to establish specific standards. Therefore, the best strategy for these particular metals, at this time, is to rely on particulate matter as a surrogate.

metals. Their rationale is that because the nonenumerated metals can be classified as either semivolatile or nonvolatile[42], they would be controlled along with the enumerated semivolatile and low volatile metals. However, MACT control would not be assured for the five nonenumerated metals even though they would be controlled by the same emission control device as the enumerated semivolatile and low volatile metals. For example, a source with high particulate matter emissions could achieve the semivolatile and low volatile metal emission standards (*i.e.*, MACT control) by feeding low levels of enumerated semivolatile and low volatile metals. But, if that source also fed high levels of nonenumerated metals, MACT control for those metals would not be achieved unless the source was subject to a particulate matter MACT standard. Consequently, we do not agree that the semivolatile and low volatile metal standards alone can serve as surrogates for the nonenumerated metals.

We also proposed to use particulate matter as a supplemental control for nondioxin/furan organic hazardous air pollutants that are adsorbed onto the particulate matter. Commenters state, however, that the Agency had not presented data showing that particulate matter in fact contains significant levels of adsorbed nondioxin/furan organic hazardous air pollutants. We now concur with commenters that, for cement kiln and lightweight aggregate kiln particulate matter, particulate matter emissions have not been shown to contain significant levels of adsorbed organic compounds. This is likely because cement kiln and lightweight aggregate kiln particulate matter is primarily inert process dust (*i.e.*, entrained raw material). Although particulate matter emissions from incinerators could contain higher levels of carbon that may adsorb some organic compounds, this is not likely a significant means of control for those organic hazardous air pollutants.[43]

B. How Are Toxic Organic Compounds Regulated by This Rule?

1. Dioxins/Furans

We proposed that dioxin/furan emissions be controlled directly with a dioxin/furan emission standard based on toxicity equivalents. The final rule adopts a TEQ approach for dioxin/furans. In terms of a source determining compliance, we expect sources to use accepted TEQ references.[44]

2. Carbon Monoxide and Hydrocarbons

We proposed that emissions of nondioxin/furan organic hazardous air pollutants be controlled by compliance with continuously monitored emission standards for either of two surrogates: carbon monoxide or hydrocarbons. Carbon monoxide and hydrocarbons are widely accepted indicators of combustion conditions. The current RCRA regulations for hazardous waste combustors use emissions limits on carbon monoxide and hydrocarbons to control emissions of nondioxin/furan toxic organic emissions. See 56 FR 7150 (February 21, 1991) documenting the relationship between carbon monoxide, combustion efficiency, and emissions of organic compounds. In addition, Clean Air Act emission standards for municipal waste combustors and medical waste incinerators limit emissions of carbon monoxide to control nondioxin/furan organic hazardous air pollutants. Finally, hydrocarbon emissions are an indicator of organic hazardous air pollutants because hydrocarbons are a direct measure of organic compounds.

Nonetheless, many commenters state that EPA's own surrogate evaluation[45] did not demonstrate a relationship between carbon monoxide or hydrocarbons and nondioxin/furan organic hazardous air pollutants at the carbon monoxide and hydrocarbon levels evaluated. Several commenters note that this should not have been a surprise given that the carbon monoxide and hydrocarbon emissions data evaluated were generally from hazardous waste combustors operating under good combustion conditions (and thus, relatively low carbon monoxide and hydrocarbon levels). Under these conditions, emissions of nondioxin/furan organic hazardous air pollutants were generally low, which made the demonstration of a relationship more difficult. These commenters note that there may be a correlation between carbon monoxide and hydrocarbons and nondioxin/furan organic hazardous air pollutants, but it would be evident primarily when actual carbon monoxide and hydrocarbon levels are higher than the regulatory levels. We agree, and conclude that carbon monoxide and hydrocarbon levels higher than those we establish as emission standards are indicative of poor combustion conditions and the potential for increased emissions of nondioxin/furan organic hazardous air pollutants. Consequently, we have adopted our proposed approach for today's final rule.[46]

3. Destruction and Removal Efficiency

We have determined that a destruction and removal efficiency (DRE) standard is needed to ensure MACT control of nondioxin/furan organic hazardous air pollutants.[47] We adopt the implementation procedures from the current RCRA requirements for DRE (see §§ 264.342, 264.343, and 266.104) in today's final rule. The rationale for adopting destruction and removal efficiency as a MACT standard is discussed later in Section IV of the preamble.

C. How Are Hydrochloric Acid and Chlorine Gas Regulated by This Rule?

We proposed that hydrochloric acid and chlorine gas emissions be controlled by a combined total chlorine MACT standard because: (1) The test method used to determine hydrochloric acid and chlorine gas emissions may not be able to distinguish between the compounds in all situations;[48] and (2) both of these hazardous air pollutants can be controlled by limiting feedrate of chlorine in hazardous waste and wet scrubbing. We have adopted this approach in today's final rule.

One commenter questions whether it is appropriate to establish a combined standard for hydrochloric acid and chlorine gas because the removal efficiency of emission control equipment is substantially different for the two pollutants. Although we agree that the efficiency of emission control equipment is substantially different for the two pollutants, we conclude that the MACT control techniques will readily

[42] As a factual matter, selenium can be classified as a semivolatile metal and the remaining four nonenumerated metals can be classified as low volatile metals.

[43] We recognize that sorbent (*e.g.*, activated carbon) may be injected into the combustion system to control mercury or dioxin/furan. In these cases, particulate matter would be controlled as a site-specific compliance parameter for these organics. See the discussion in Part Five of this preamble.

[44] For example, USEPA, ''Interim Procedure for Estimating Risks Associated With Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs) and 1989 Update'', March 1989; Van den Berg, M., *et al.* ''Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife'' *Environmental Health Perspectives*, Volume 106, Number 12, December 1998.

[45] See Energy and Environmental Research Corporation, ''Surrogate Evaluation of Thermal Treatment Systems,'' Draft Report, October 17, 1994.

[46] As discussed at proposal, however, this relationship does not hold for certain types of cement kilns where carbon monoxide and hydrocarbons emissions evolve from raw materials. See discussion in Section VII of Part Four.

[47] Under this standard, several difficult to combust organic compounds would be identified and destroyed or removed by the combustor to at least a 99.99% (or 99.9999%, as applicable) efficiency.

[48] See the proposed rule, 61 FR at 17376.

enable sources to achieve the hydrochloric acid/chlorine gas emission standard. As discussed in Sections VI, VII, and VIII below, MACT control for all hazardous waste combustors is control of the hazardous waste chlorine feedrate. This control technique is equally effective for hydrochloric acid and chlorine gas and represents MACT control for cement kilns. MACT control for incinerators also includes wet scrubbing. Although wet scrubbing is more efficient for controlling hydrochloric acid, it also provides some control of chlorine gas. MACT control for lightweight aggregate kilns also includes wet or dry scrubbing. Although dry scrubbing does not control chlorine gas, chlorine feedrate control combined with dry scrubbing to remove hydrochloric acid will enable lightweight aggregate kilns to achieve the emission standard for hydrochloric acid/chlorine gas.

III. How Are the Standards Formatted in This Rule?

A. What Are the Units of the Standards?

With one exception, the final rule expresses the emission standards on a concentration basis as proposed, with all standards expressed as mass per dry standard cubic meter (*e.g.*, µg/dscm), with hydrochloric acid/chlorine gas, carbon monoxide, and hydrocarbon standards being expressed at parts per million by volume (ppmv). The exception is the particulate matter standard for hazardous waste burning cement kilns where the standard is expressed as kilograms of particulate matter per Mg of dry feed to the kiln.

Several commenters suggest that the standards should be expressed on a mass emission basis (*e.g.*, mg/hour) because of equity concerns across source categories and environmental loading concerns. They are concerned that expressing the standards on a concentration basis allows large gas flow rate sources such as cement kilns to emit a much greater mass of hazardous air pollutants per unit time than smaller sources such as some on-site incinerators. Concomitantly, small sources would incur a higher cost/lb of pollutant removed, they contend, than a large source.[49] Further, they reason that the larger sources would pose a much greater risk to human health and the environment because risk is a function of mass emissions of pollutants per unit of time.

[49] This result is not evident given that the cost of an emission control device is generally directly proportional to the gas flow rate, not the mass emission rate of pollutants per unit time.

Although we agree with commenters' point about differential environmental loadings attributable to small versus large sources with a concentration-based standard, we note that the mass-based standard urged here is inherently incompatible with technology-based MACT standards for several reasons.[50] A mass-based standard does not ensure MACT control at small sources. Small sources have lower flow rates and thus would be allowed to emit hazardous air pollutants at high concentrations. They could meet the standard with no or minimal control. In addition, this inequity between small and large sources would create an incentive to divert hazardous waste from large sources to small sources (existing and new), causing an increase in emissions nationally.

B. Why Are the Standards Corrected for Oxygen and Temperature?

As proposed, the final standards are corrected to 7 percent oxygen and 20°C because the data we use to establish the standards are corrected in this manner and because the current RCRA regulations for these sources require this correction. These corrections normalize the emissions data to a common base, recognizing the variation among the different combustors and modes of operation.

Several commenters note that the proposed oxygen correction equation does not appropriately address hazardous waste combustors that use oxygen enrichment systems. They recommend that the Agency promulgate the oxygen correction factor equation proposed in 1990 for RCRA hazardous waste incinerators. See 55 FR at 17918 (April 27, 1990). We concur, and adopt the revised oxygen correction factor equation.

C. How Does the Rule Treat Significant Figures and Rounding?

As proposed, the final rule establishes standards and limits based on two significant figures. One commenter notes that a minimum of three significant figures must be used for all intermediate calculations when rounding the results to two significant figures. We concur. Sources should use standard procedures, such as ASTM procedure E–29–90, to round final emission levels to two significant figures.

[50] Although the particulate matter standard for hazardous waste burning cement kilns in today's rule is the New Source Performance Standard expressed as on a mass basis (*i.e.*, kg of particulate matter per megagram of dry feed to the kiln), this standard is not based on a ''mass of particulate matter emissions per unit of time'' that commenters suggest. Rather, the cement kiln standard can be equated to a concentration basis given that cement kilns emit a given quantity of combustion gas per unit of dry feed to the kiln. In fact, we proposed the cement kiln particulate matter standard on a concentration basis, 0.03 gr/dscf, that was calculated from the New Source Performance Standard when applied to a typical wet process cement kiln.

IV. How Are Nondioxin/Furan Organic Hazardous Air Pollutants Controlled?

Nondioxin/furan organic hazardous air pollutants are controlled by a destruction and removal efficiency (DRE) standard and the carbon monoxide and hydrocarbon standards. Previous DRE tests demonstrating compliance with the 99.99% requirement under current RCRA regulations may be used to document compliance with the DRE standard provided that operations have not been changed in a way that could reasonably be expected to affect ability to meet the standard. However, if waste is fed at a point other than the flame zone, then compliance with the 99.99% DRE standard must be demonstrated during each comprehensive performance test, and new operating parameter limits must be established to ensure that DRE is maintained. A 99.9999% DRE is required for those hazardous waste combustors burning dioxin-listed wastes. These requirements are discussed in Section IV.A. below.

In addition, the rule establishes carbon monoxide and hydrocarbons emission standards as surrogates to ensure good combustion and control of nondioxin/furan organic hazardous air pollutants. Continuous monitoring and compliance with either the carbon monoxide or hydrocarbon emissions standard is required. If you choose to continuously monitor and comply with the carbon monoxide standard, you must also demonstrate during the comprehensive performance test compliance with the hydrocarbon emission standard. Additionally, you must also set operating limits on key parameters that affect combustion conditions to ensure continued compliance with the hydrocarbon emission standard. Alternatively, continuous monitoring and compliance with the hydrocarbon emissions standard eliminates the need to monitor carbon monoxide emissions because hydrocarbon emissions are a more direct surrogate of nondioxin/furan organic hazardous air pollutant emissions. These requirements are discussed in Section IV.B below.

A. What Is the Rationale for DRE as a MACT Standard?

All sources must demonstrate the ability to destroy or remove 99.99

percent of selected principal organic hazardous compounds in the waste feed as a MACT standard. This requirement, commonly referred to as four-nines DRE, is a current RCRA requirement. We are promulgating the DRE requirement as a MACT floor standard to control the emissions of nondioxin organic hazardous air pollutants. The rule also requires sources to establish limits on specified operating parameters to ensure compliance with the DRE standard. See Part Five Section VII(B).

In the April 1996 NPRM, we proposed that the four-nines DRE test requirement be retained under RCRA and be performed as part of a RCRA approved trial burn because we did not believe that the DRE test could be adequately implemented using the generally self-implementing MACT performance test and notification process.[51] See 61 FR 17447.

In response to the April proposal, however, we received comments that suggest the MACT comprehensive performance test and RCRA DRE trial burn could and should be combined, and that we should combine all stack air emission requirements for hazardous waste combustors into a single permit. Commenters are concerned that our proposed approach required sources to obtain two permits for air emissions and potentially be unnecessarily subject to dual enforcement.

We investigated approaches that would achieve the goals of a single air emission permit and inclusion of DRE in MACT. We determined that the 40 CFR part 63 general provisions, applicable to all MACT regulated sources unless superseded, includes a process similar to the process to develop a RCRA trial burn test plan and allows permitting authorities to review and approve MACT performance test plans. See 40 CFR 63.7. Additionally, we determined that, because all hazardous waste combustors are currently required to achieve four-nines DRE, the DRE requirement could be included as a MACT floor standard rather than a RCRA requirement. In the May 1997 NODA, we discussed an alternative approach that used a modified form of the general provision's performance test plan and approval process. The approach would allow combination of the DRE test with the comprehensive performance test and, therefore, facilitate implementation of DRE as a MACT standard. We also discussed modifying the general approach to extend the performance test plan review period to one year in advance of the date a source plans to perform the comprehensive performance test. This extended review period would provide sufficient time for negotiations between permitting authorities and sources to develop and approve comprehensive performance test plans. These test plans would identify operating parameter limits necessary to ensure compliance with all the proposed MACT standards, as well as, implement the four-nines DRE test as a MACT floor standard. See 62 FR at 24241. Commenters support the process to combine the applicable stack emission requirements into a single permit. As for making the DRE test a MACT standard, we received no negative comments. Many commenters, however, question the need for subsequent DRE testing once a unit demonstrates four-nines DRE. See discussion and our response in Subsection 2 below.

We believe that requiring the DRE test as a MACT standard is appropriate. As we previously noted, the four-nines DRE is firmly grounded statutory and regulatory requirement that has proven to be an effective method to determine appropriate process controls necessary for the combustion of hazardous waste. Specifically, RCRA requires that all hazardous waste incinerators must demonstrate the minimum technology requirement of four-nines DRE (RCRA section 3004(o)(1)(B)). Additionally, the current RCRA BIF regulations require that all boiler and industrial furnaces meet the four-nines DRE standard. Moreover, current RCRA regulations require all sources incinerating certain dioxin-listed contaminated wastes (F020–023 and F026–27) to achieve 99.9999% (six-nines) DRE. See §§ 264.343(a)(2) and 266.104(a)(3).

The statutory requirement for incinerators to meet four-nines DRE can be satisfied if the associated MACT requirements ensure that incinerators will continue to meet the four-nines DRE minimum technology requirement, *i.e.*, that MACT standards provide at least the ''minimum'' RCRA section 3004(o)(1) level of control. To determine if the RCRA statutory requirements could be satisfied, we investigated whether DRE could be replaced with universal standards for key operating parameters based on previous DRE demonstrations (*i.e.*, standards for carbon monoxide and hydrocarbon emissions). We found that, in the vast majority of DRE test conditions, if a unit operated with carbon monoxide levels of less than 100 ppmv and hydrocarbon emissions of less than 10 ppmv, the unit met or surpassed four-nines DRE. In a small number of test conditions, units emitted carbon monoxide and hydrocarbons at levels less than 100 and 10 ppmv respectively, but failed to meet four-nines DRE. Most failed test conditions were either due to questionable test results or faulty test design.[52] See U.S. EPA, ''Draft Technical Support Document for HWC MACT Standards (NODA), Volume II: Evaluation of CO/HC and DRE Database,'' April 1997. Even though we could potentially explain the reasons these units failed to achieve four-nines DRE, we determined that universal carbon monoxide and hydrocarbon emissions limits may not ensure that all units achieve four-nines DRE because carbon monoxide and hydrocarbon emissions may not be representative of good combustion for all operating conditions that facilities may desire to operate. In addition, we could not identify a better method than the DRE test to limit combustion failures modes.

Commenters state that the test conditions under which the DRE failures occurred involved feeding practices that were not common in the hazardous waste combustion industry. They further state that, if it could be ensured that hazardous waste ignited, hydrocarbon and carbon monoxide limits would be sufficient to ensure four-nines DRE is achieved continuously. Therefore, a DRE demonstration would not be warranted. Although we might agree in theory, the fact that tests were performed under these test conditions indicates that a source desired to operate in that fashion. Only the DRE test identified that the combustion failure occurred and was not susceptible to control via carbon monoxide and hydrocarbon emissions. This and other similar failures can lead to increased emissions of products of incomplete combustion and organic hazardous air pollutants. Also, as commenters acknowledge, carbon monoxide and hydrocarbon emissions were effective surrogates to ensure four-nines DRE only when

[51] Historically, under RCRA regulations, the permittiing authority and hazardous waste combustion source found it necessary to go through lengthy negotiations to develop a RCRA trial burn plan that adequately demonstrates the unit's ability to achieve four-nines DRE.

[52] In many of the failed test conditions that we investigated, the facility fed a low concentration of organic compound on which the DRE was being calculated. As has been observed many times, organic compounds can be reformed in the post combustion gas stream at concentrations sufficient to fail DRE. This is not indicative of a failure in the systems ability to destroy the compound, but is more likely the result of a poorly designed test. If the facility had fed a higher concentration of organic compound in the waste to the combustor, the unit would have been more likely to meet four-nines DRE with no change in the operating conditions used during the test. In other cases, poor test design (*i.e.*, firing aqueous organic waste into an unfired secondary combustion chamber) is considered to be the cause.

hazardous waste ignited. However, as we identified in the May 1997 NODA, there are a number of hazardous waste combustion sources that operate in a manner that does not ensure ignition of hazardous waste.

As a result of the DRE test investigation, we determined that a successful DRE demonstration is an effective, appropriate, and necessary method to identify operating parameter limits that ensure proper and achievable combustion of hazardous waste and to limit the emissions of organic hazardous air pollutants. Additionally, the DRE standard is a direct measure to ensure that the RCRA section 3004(o)(1) mandate and its protectiveness goals are being met, and also serves to maintain a consistent test protocol for sources combusting hazardous waste. The DRE demonstration requirement is also reasonable, provides a sound means to allow deferral of a RCRA mandate to the CAA, and simplifies implementation by having all stack emissions-related testing and compliance requirements promulgated under one statute, the CAA. Therefore, we retain the DRE demonstration as part of the MACT comprehensive performance test unless a DRE test has already been performed with no relevant changes.

1. MACT DRE Standard

In today's rule, all affected sources are required to meet 99.99% DRE of selected Principal Organic Hazardous Constituents (POCs) that are as or more difficult to destroy than any organic hazardous pollutant fed to the unit. With one exception discussed in subsection 3 below, this demonstration need be made only once during the operational life of a source, either before or during the initial comprehensive performance test, provided that the design, operation, and maintenance features do not change in a manner that could reasonably be expected to affect the ability to meet the DRE standard.

The DRE demonstration involves feeding a known mass of POHC(s) to a combustion unit, and then measuring for that POHC(s) in stack emissions. If the POHC(s) is emitted at a level that exceeds 0.01% of the mass of the individual POHC(s) fed to the unit, the unit fails to demonstrate sufficient DRE.

Operating limits for key combustion parameters are used to ensure four-nines DRE is maintained. The operating parameter limits are established based on operations during the DRE test. Examples of combustion parameters that are used to set operating limits include minimum combustion chamber temperature, minimum gas residence time, and maximum hazardous waste feedrate by mass. See § 63.1209(j).

Today's MACT DRE requirement is essentially the same as that currently required under RCRA. The main difference is that the vast majority of the MACT DRE demonstrations would not have to be repeated as often as currently required under RCRA, as discussed in section 3 below.

2. How Can Previous Successful Demonstrations of DRE Be Used To Demonstrate Compliance?

Except as discussed below, today's rule requires that, at least once during the operational life of a source during or before the initial comprehensive performance test, the source must demonstrate the ability to achieve 99.99% DRE and must set operating parameter limits to ensure that DRE is maintained. However, we recognize that many sources have already undergone approved DRE testing. Further, many facilities do not intend to modify their units design or operations in such a way that DRE performance or parameters would be adversely affected. Therefore, the Agency is allowing sources to use results from previous EPA or State-approved DRE demonstrations to fulfill the MACT four-nines DRE requirement, as well as to set the necessary operating limits on parameters that ensure continued compliance.

If a facility wishes to operate under new operating parameter limits that could reasonably be expected to affect the ability to meet the standard, a new DRE demonstration must be performed before or concurrent with the comprehensive performance test. If the DRE operating limits conflict with operating parameter limits that are set to ensure compliance with other MACT standards, the unit must comply with the more stringent limits. Additionally, if a source is modified in such a way that its DRE operating limits are no longer applicable or valid, the source must perform a new DRE test. Moreover, if a source is modified in any way such that DRE performance or parameters are affected adversely, the source must perform a new DRE test.

3. DRE for Sources That Feed Waste at Locations Other Than the Flame Zone

Today's rule requires sources that feed hazardous waste in locations other than the flame zone to perform periodic DRE tests to ensure that four-nines DRE continues to be achieved over the life of the unit. As indicated in the May 1997 NODA at 62 FR 25877, the Agency is concerned that these types of sources have a greater potential of varying DRE performance due to their waste firing practices. That is, due to the unique design and operation of the waste firing system, the DRE may vary over time, and those variations cannot be identified or limited through operating limits set during a single DRE test. For these units, we are requiring that DRE be verified during each comprehensive performance test and that new operating parameter limits be established to ensure continued compliance.

4. Sources That Feed Dioxin Wastes

In today's rule, we are requiring all sources that feed certain dioxin-listed wastes (*i.e.*, F020–F023, F026, F027) to demonstrate the ability to achieve 99.9999 percent (six-nines) DRE as a MACT standard. This requirement will serve to achieve a number of goals associated with today's regulations. First, under RCRA, six-nines DRE is required when burning certain dioxin-listed wastes. If we did not promulgate this requirement as a MACT standard, sources that feed dioxin-listed waste would be required to maintain two permits to manage their air emissions. Thus, by including this requirement as a MACT standard, we eliminate any unnecessary duplication. That outcome is contrary to our goal which is to limit, to the greatest extent possible, the need for sources to obtain two permits governing air emissions under different statutory authorities. Second, six-nines DRE helps to improve control of nondioxin organic hazardous air pollutants as well. Finally, this requirement properly reflects floor control for sources that feed dioxin-listed wastes. Currently, all sources that feed dioxin listed wastes must achieve six-nines DRE. Before making the decision to include six-nines DRE as a MACT standard, we considered whether the requirements could be eliminated given that we are issuing dioxin/furan emission standards with today's rule. We concluded, first, that we had not provided sufficient notice and comment to depart from the current regulations applicable to these sources. Second, we also decided that because we currently require other similar highly toxic bioaccumulative and persistent compounds (*e.g.*, PCB wastes) to be fed to units that demonstrate six-nines DRE, a departure from that policy for RCRA dioxin wastes would be inconsistent. Finally, we are in discussions that may cause us to reevaluate our overall approach to dioxin-listed wastes, with the potential to impact this rule and the land disposal restrictions program. Any changes to our approach will be included in a single rulemaking that would be proposed later.

B. What Is the Rationale for Carbon Monoxide or Hydrocarbon Standards as Surrogate Control of Organic Hazardous Air Pollutants?

Today's rule adopts limits on emissions of carbon monoxide and hydrocarbons as surrogates to ensure good combustion and control of nondioxin organic hazardous air pollutants. We require continuous emissions monitoring and compliance with either the carbon monoxide or hydrocarbon emissions standard. Sources can choose which of these two standards it wishes to continuously monitor for compliance. If a source chooses the carbon monoxide standard, it must also demonstrate during the comprehensive performance test compliance with the hydrocarbon emission standard. During this test the source also must set operating limits on key parameters that affect combustion conditions to ensure continued compliance with the hydrocarbon emission standard. These parameters relate to good combustion practices and are identical to those for which you must establish limits under the DRE standard. See § 63.109(a)(7) and 63.1209(j). However, this source need not install and use a continuous hydrocarbon monitor to ensure continued compliance with the hydrocarbon standard. As discussed previously, the limits established for DRE are identical. If a source elects to use the hydrocarbon limit for compliance, then it must continuously monitor and comply with the hydrocarbon emissions standard. However, this type of source need not monitor carbon monoxide emissions or carbon monoxide operating parameters because hydrocarbon emissions are a more direct surrogate of nondioxin organic hazardous air pollutant emissions.

The April 1996 NPRM proposed MACT emission standards for both carbon monoxide and hydrocarbon as surrogates to control emissions of nondioxin organic hazardous air pollutants. We also proposed that cement kilns comply with either a carbon monoxide or hydrocarbons standard due to raw material considerations.[53] See 61 FR at 17375–6. Our reliance on only carbon monoxide or only hydrocarbon has drawbacks, and therefore we proposed that incinerators and lightweight aggregate kilns comply with emissions standards for both. Nonetheless, we also acknowledged that requiring compliance with both carbon monoxide and hydrocarbon standards may be redundant, and requested comment on: (1) Giving sources the option of complying with either carbon monoxide or hydrocarbon emission standards; or (2) establishing a MACT standard for either carbon monoxide or hydrocarbon, but not both.

Comments to our proposed approach question the necessity of two related surrogates to control organic hazardous air pollutants. Many commenters assert they are capable of controlling hydrocarbon emissions effectively, but due to their system's unique design, they could not comply continuously with the carbon monoxide emission standard. In general, commenters prefer an approach that would afford them maximum flexibility in demonstrating compliance with organic control standards, *i.e.*, more like option (1) in the NPRM.

The May 1997 NODA included a refined version of the option that commenters prefer that allowed sources to monitor and comply with either a carbon monoxide or hydrocarbon emission standard. In response to the May 1997 NODA, commenters nearly unanimously support the option that allowed facilities to monitor and comply with either the carbon monoxide or hydrocarbon standard as surrogates to limit emissions of nondioxin organic hazardous air pollutants. However, a few commenters suggest that compliance with carbon monoxide or hydrocarbons in combination with DRE testing is redundant and unnecessary. However, in their comments, they do not address the issue of DRE failures associated with low carbon monoxide or hydrocarbon emissions, other than to state that if ignition failure was avoided, emissions of carbon monoxide or hydrocarbons would be good indicators of combustion efficiency and four-nines DRE. This does not address our concerns, which reflect cases in which ignition failures did not occur and in which destruction and removal efficiencies were not met.

In the May 1997 NODA, we discussed another option that required sources to comply with the hydrocarbon emission standard and establish a site-specific carbon monoxide limit higher than 100 ppmv. This option was developed because compliance with the hydrocarbon standard assures control of nondioxin organic hazardous air pollutants, and a site-specific carbon monoxide limit aids compliance by providing advanced information regarding combustion efficiency. However, we conclude that this option may be best applied as a site-specific remedy in situations where a source has trouble maintaining compliance with the hydrocarbon standard.

Today's final rule modifies the May 1997 NODA approach slightly. Complying with the carbon monoxide standard now requires documentation that hydrocarbon emissions during the performance test are lower than the standard, and requires operating limits on parameters that affect hydrocarbon emissions. We adopt this modification because some data show that high hydrocarbon emissions are possible while simultaneously low carbon monoxide emissions are found.[54]

In the BIF rule (56 FR at 7149–50), we found that both monitoring and compliance with either carbon monoxide or hydrocarbon limits and achieving four-nines DRE is needed to ensure control of products of incomplete combustion (including nondioxin organic hazardous air pollutants) that are a result of hazardous waste combustion. DRE, although sensitive to identifying combustion failure modes, cannot independently ensure that emissions of products of incomplete combustion or organic hazardous air pollutants are being controlled. DRE can only provide the assurance that, if a hazardous waste combustor is operating normally, the source has the capability to transform hazardous and toxic organic compounds into different compounds through oxidation. These other compounds can include carbon dioxide, water, and other organic hazardous air pollutants. Because carbon monoxide provides immediate information regarding combustion efficiency potentially leading to emissions of organic hazardous air pollutants and hydrocarbon provides a direct measure of organic emissions, these two parameters individually or in combination provide additional control that would not be realized with the DRE operating parameter limits alone.[55] Neither our data nor data supplied by commenters show that only monitoring

[53] See discussion regarding cement kilns compliance with the carbon monoxide and/or hydrocarbon standards in Part Four, Section VII.D.

[54] In a number of instances, RCRA compliance test records showed that sources emitting carbon monoxide at less than 100 ppmv emitted hydrocarbons in excess of 10 ppmv.

[55] We acknowledge that although hydrocarbon emissions are a direct measure of organic emissions, they are measured with a continuous emissions monitoring system known as a flame ionization detector. Some data suggest hydrocarbon flame ionization detectors do not respond with the same sensitivity to the full spectrum of organic compounds that may be present in the combustion gas. Additionally, combustion gas conditions also may affect the sensitivity and accuracy of the monitor. Nonetheless, monitoring hydrocarbons with these detectors appears to be the best method reasonably available to provide real-time monitoring of organic emissions from a hazardous waste combustor.

carbon monoxide, hydrocarbons, or DRE by itself can adequately ensure control of nondioxin organics. Therefore, the approach used in the BIF rule still provides the best regulatory model. We conclude in today's rule that hydrocarbons and carbon monoxide monitoring are not redundant with the DRE testing requirement to control emissions of organic hazardous air pollutants and require both standards. For an additional discussion regarding the use of hydrocarbons and carbon monoxide to control emissions of organic hazardous air pollutants, see USEPA, ''Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

V. What Methodology Is Used To Identify MACT Floors?

This section discusses: (1) Methods used to identify MACT floor controls and emission levels for the final rule; (2) the rationale for using hazardous waste feedrate control as part of MACT floor control for the metals and total chlorine standards; (3) alternative methods for establishing floor levels considered at proposal and in the May 1997 NODA; and (4) our consideration of emissions variability in identifying MACT floor levels.

A. What Is the CAA Statutory Requirement To Identify MACT Floors?

We identify hazardous waste incinerators, hazardous waste burning cement kilns, and hazardous waste burning lightweight aggregate kilns as source categories to be regulated under section 112. We must, therefore, develop MACT standards for each category to control emissions of hazardous air pollutants. Under CAA section 112, we may distinguish among classes, types and sizes of sources within a category in establishing such standards.

Section 112 prescribes a minimum baseline or ''floor'' for standards. For new sources, the standards for a source category cannot be less stringent than the emission control that is achieved in practice by the best-controlled similar source. Section 112(d)(3). The standards for existing sources may be less stringent than standards for new sources, but cannot be less stringent than ''(A) * * * the average emissions limitation achieved by the best performing 12 percent of the existing sources (for which the Administrator has emissions information) * * *, in the category or subcategory for categories and subcategories with 30 or more sources, or (B) the average emissions limitation achieved by the best performing 5 sources (for which the Administrator has or could reasonably obtain emissions information) in the category or subcategory for categories and subcategories with fewer than 30 sources.'' *Id.*

We also must consider a more stringent standard than the floor, referred to in today's rule as a ''beyond-the-floor'' standard. For each beyond-the-floor analysis, we evaluate the maximum degree in reduction of hazardous air pollutants determined to be achievable, taking into account the cost of achieving those reductions, nonair quality health and environmental impacts, and energy costs. Section 112(d)(2). The object of a beyond-the-floor standard is to achieve the maximum degree of emission reduction without unreasonable economic, energy, or secondary environmental impacts.

B. What Is the Final Rule Floor Methodology?

Today's rule establishes MACT standards for the following hazardous air pollutants, hazardous air pollutant groups or hazardous air pollutant surrogates: dioxin/furans, mercury, two semivolatile metals (lead and cadmium), three low volatile metals (arsenic, beryllium, and chromium), particulate matter, total chlorine (hydrochloric acid and chlorine gas), carbon monoxide, hydrocarbons, and destruction and removal efficiency. This subsection discusses the overall engineering evaluation and data analysis methods we used to establish MACT floors for these standards. Additional detail on the specific application of these methods for each source category and standard is presented in Part Four, Sections VI–VIII, of the preamble and in the technical support document.[56]

1. What Is the General Approach Used in This Final Rule?

The starting point in developing standards is to determine a MACT floor emission level, the most lenient level at which a standard can be set. To identify the floor level, we first identified the control techniques used by the best performing sources. We designate these best performing sources the ''MACT pool'' and the emission control technologies they use we call ''MACT floor controls.''

After identifying the MACT pool and MACT floor controls, we determine the emission level that the MACT floor controls are routinely achieving—that is, an achievable emission level taking into account normal operating variability (*i.e.*, variability inherent in a properly designed and operated control system). This is called the floor emission level. To ensure that the floor emission level is being achieved by all sources using floor controls (*i.e.*, not just the MACT pool sources), we generally consider emissions data from all sources in a source category that use well-designed and properly operated MACT floor controls. (We call the data set of all sources using floor controls the ''expanded MACT pool.'') Floor levels in this rule are generally established as the level achieved by the source in the expanded MACT pool with the highest emissions average[57] using well-designed and properly operated MACT floor controls.

Several commenters oppose considering emissions data from all sources using MACT floor controls (*i.e.*, the expanded MACT pool) because they assert the expansion of the MACT pool results in inflated floors. If we adopt these commenters' recommendation, then many sources using MACT controls would not meet the standard, even though they were using MACT floor control. (Indeed, in some cases, other test conditions from the very system used to establish the MACT pool would not meet the standard, notwithstanding no significant change in the system's design and operation.) This result is inappropriate in that all sources using properly designed and operated MACT floor controls should achieve the floor emission level if the technology is well designed and operated. In the absence of data indicating a design or operation problem, we assume the floor emission level based on an expanded MACT pool reflects an emission level consistently achievable by MACT floor technology. Our resulting limits account for the fact that sources and emissions controls will experience normal operating variability even when properly designed and operated.

The MACT floor methodology in this rule does not use a single uniform data analysis approach consistently across all three source categories and standards. Our data analysis methods vary due to: (1) Limitations of our emissions data and ancillary information; (2) emissions of some hazardous air pollutants being related to the feedrate of the hazardous air pollutant (*e.g.*, semivolatile metal emissions are affected by semivolatile metal feedrates) while emissions of

[56] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

[57] Each source's emissions usually are expressed as an average of three or more emission measurements at the same set of operating parameters. This is because compliance is based on the average of three or more runs.

other hazardous air pollutants are not (*e.g.*, dioxin/furan emissions are related to postcombustion dioxin/furan formation rather than dioxin/furan feedrates); (3) the various types of emissions controls currently in use which do not lend themselves to one type of MACT analysis; and (4) consideration of existing regulations as themselves establishing floor levels.

Finally, as discussed in Section D, the MACT floor levels established through our data analysis approaches account for emissions variability without the separate addition of a statistically-derived emissions variability factor.

2. What MACT Floor Approach Is Used for Each Standard?

a. Dioxins and Furans. For dioxins and furans, we adopt the MACT floor methodology discussed in the May 1997 NODA. Based on engineering information and principles, we identify temperature of combustion gas at the particulate matter control device of 400°F or less as MACT floor control of dioxin/furan. This technology and level of control has been selected because postcombustion formation of dioxin/furan is suppressed by lowering postcombustion gas temperatures, and formation is reasonably minimized at gas temperatures of 400°F or below. Sources controlling gas temperatures to 400°F or less at the particulate matter control device represent the level achieved by the median of the best performing 12 percent of sources where the source category has more than 30 sources (or the median of the best performing five sources where the source category has fewer than 30 sources).

The next step is to identify an emissions level that MACT floor control achieved on a routine basis. We analyzed the emissions data from all sources (within each source category) using MACT floor control and establish the floor level equal to the highest test condition average.

As discussed in greater detail in Part Four, Section VI, incinerators with waste heat recovery boilers present a unique situation for dioxin/furan control. Our data base shows that incinerators equipped with waste heat recovery boilers have significantly higher dioxin/furan emissions compared to other incinerators. In the waste heat recovery boiler, combustion gas is exposed to particles on boiler tubes within the temperature window of 450° F to 650° F, which promotes surface-catalyzed formation of dioxin/furan. Therefore, we establish separate dioxin/furan standards for incinerators with waste heat boilers and incinerators without waste heat boilers.[58] The specified floor control for both waste heat boilers and nonwaste heat boilers is combustion gas temperature control to 400°F or less at the particulate matter control device.[59] Floor levels for waste heat boiler incinerators are much higher, however, because of the dioxin/furan formation during the relatively slow temperature quench in the boiler. See the incinerator dioxin/furan discussion in Part Four, Section VI, of today's rule for more details.

b. What MACT Floor Methodology Is Used for Particulate Matter? We adopt a final MACT floor methodology for particulate matter based on the approaches discussed in the May 1997 NODA. For incinerators, the final MACT floor is determined through engineering principles and information, coupled with analysis of the emissions data base. For cement kilns, we base final MACT on the existing requirements of the New Source Performance Standard applicable to Portland cement kilns. Finally, for lightweight aggregate kilns, the final floor level is derived directly from the emissions data base (*i.e.*, the highest test condition average for sources using properly designed and operated floor control).

i. Incinerators. Today's rule identifies MACT floor control as either a well-designed, operated, and maintained fabric filter, ionizing wet scrubber, or electrostatic precipitator, based on engineering information and an evaluation of the particulate matter control equipment used by at least the median of the best performing 12 percent of sources and the emission levels achieved. These types of particulate matter control equipment routinely and consistently achieve superior particulate matter performance relative to other controls used by the incinerator source category and thus represent MACT. Using generally accepted engineering information and principles, we then identify an emission level that well-designed, operated and maintained fabric filters, ionizing wet scrubbers, and electrostatic precipitators routinely achieve.

The floor level is not directly identified from the emissions data base as the highest test condition average for sources using a fabric filter, ionizing wet scrubber, or electrostatic precipitator. The hazardous waste combustor incinerator data base, however, was used as a tool to determine if the identified floor level, established on generally accepted engineering information and principles, is in general agreement with available particulate matter data. This is because we do not have adequate data on the features of the control devices to accurately distinguish only those devices that are well-designed, operated, and maintained and thus representative of MACT. Several sources in the emissions data base that are equipped with fabric filters, ionizing wet scrubbers, or electrostatic precipitators have emission levels well above the emission levels of other sources equipped with those devices. This strongly suggests that the higher levels are not representative of those achieved by well-designed, operated, and maintained units, even when normal operating variability is considered. We accordingly did not use these data in establishing the standard. See *Kennecott* v. *EPA*, 780 F.2d 445, 458 (4th Cir. 1985) (EPA ''can reject data it reasonably believes to be unreliable including performance data that is higher than other plants operating the same control technology.'')

ii. Cement Kilns. As discussed in the May 1997 NODA and in more detail in the standards section for cement kilns in Part Four, Section VII, we base the MACT floor emission level on use of a fabric filter or electrostatic precipitator to achieve the New Source Performance Standard for Portland cement kilns. The MACT floor is equivalent to and expressed as the current New Source Performance Standard of 0.15 kg/Mg dry feed (0.30 lb/ton dry feed). In the NPRM and the May 1997 NODA, we proposed to express the particulate matter standard on a concentration basis. However, because we are not yet requiring sources to document compliance with the particulate matter standard by using a particulate matter continuous emissions monitoring system in this final rule, we establish and express the floor emission level equivalent to the New Source Performance Standard. Commenters' concerns about separate MACT pools for particulate matter, semivolatile metals, and low volatile metals are discussed in Part Four, Section VII.

iii. Lightweight Aggregate Kilns. All lightweight aggregate kilns burning

[58] We concluded that separate standards to control other hazardous air pollutants were not needed for waste heat boiler-equipped incinerators versus other incinerators. That is, whether or not the incinerator is equipped with a waste heat recovery boiler is only of concern for dioxin/furan emissions, not the other hazardous air pollutants.

[59] Wet particulate matter control devices (*e.g.*, venturi scrubbers) inherently preclude dioxin/furan formation because: (1) They do not suspend particulate matter in the combustion gas flow as do fabric filters and electrostatic precipitators, and (2) gas temperatures are below 400°F in the scrubber. Given this, floor control is use of a wet particulate matter control device or control of combustion gas temperature to 400°F or below at the inlet to a dry particulate matter control device.

hazardous waste are equipped with fabric filters. We could not distinguish only those sources with fabric filters better designed, operated, and maintained than others, and thus represent MACT control. Because we could not independently use engineering information and principles to otherwise distinguish which well-designed, operated, and maintained fabric filters are routinely achieving levels below the highest test condition average in the emissions data base (*i.e.*, considering the high inlet grain loadings for lightweight aggregate kilns), we establish the floor level as that highest test condition average emission level. Commenters concerns about a high floor level and separate MACT pools for particulate matter, semivolatile metals, and low volatile metals are discussed in Part Four, Section VIII.

c. Metals and Total Chlorine. This rule establishes MACT standards for mercury; semivolatile metals comprised of combined emissions of lead and cadmium; low volatility metals comprised of combined emissions of arsenic, beryllium, and chromium; and total chlorine comprised of combined emissions of hydrogen chloride and chlorine gas. As shown by the following analysis, these hazardous air pollutants are all controlled by the best performing sources, at least in part, by feedrate control of the metal or chlorine in the hazardous waste. In addition to hazardous waste feedrate control, some of the hazardous air pollutants also are controlled by air pollution control equipment. Both semivolatile metals and low volatile metals are controlled by a combination of hazardous waste metal feedrate control and by particulate matter control equipment. Total chlorine is controlled by a combination of feedrate control and, for hazardous waste incinerators, scrubbing equipment designed to remove acid gases.

i. How Are the Metals and Chlorine Floor Control(s) Identified? We follow the language of CAA section 112(d)(3) to identify the control techniques used by the best performing sources. The hazardous waste incinerator and hazardous waste cement kiln source categories are comprised of 186 and 33 sources, respectively. From the statutory language, we conclude that for this analysis the control techniques used by the best performing 6% of sources represents the average of the best performing 12% of the sources in those categories. It follows, therefore, that floor control for metals and chlorine is the technique(s) used by the best performing 12 incinerators and two cement kilns.

Because the hazardous waste lightweight aggregate kiln source category is comprised of only 10 sources, we follow the language of section 112(d)(3)(B) to identify the control technique(s) used by the three best performing sources, which represents the median of the best performing five sources.

Our floor control analysis indicates that the best performing 12 incinerators, two cement kilns, and three lightweight aggregate kilns all use hazardous waste feedrate control to limit emissions of mercury, semivolatile metal, low volatile metal, and total chlorine. For the semivolatile and low volatile metals, the best performing sources also use particulate matter control as part of the floor control technique. In addition, the best performing incinerator sources also control total chlorine and mercury with wet scrubbing. Accordingly, we identify floor control for semivolatile metal and low volatile metal as hazardous waste feedrate control plus particulate matter control, and floor control for incinerators for total chlorine and mercury as hazardous waste feedrate control plus wet scrubbing.

ii. What is the Rationale for Using Hazardous Waste Feedrate Control as MACT Floor Control Technique? As discussed above, MACT floor control for mercury, semivolatile metals, low volatile metals, and total chlorine is based on, or at least partially based on, feedrate control of metal and chlorine in the hazardous waste. The feedrate of metal hazardous air pollutants will affect emissions of those pollutants, and the feedrate of chlorine will affect emissions of total chlorine (*i.e.*, hydrochloric acid and chlorine gas) because metals and chlorine are elements and are not destroyed during combustion. Emissions controls, if any, control only a percentage of the metal or total chlorine fed. Therefore, as concentrations of metals and total chlorine in the inlet to the control device increase, emissions increase.

At proposal, we identified hazardous waste feedrates as part of the technology basis for the proposed floor emission standards.[60] MACT maximum theoretical emission concentrations[61] (MTECs) were established individually for mercury, semivolatile metals, low volatile metals, and total chlorine at a level equal to the highest MTEC of the average of the best performing 12% of sources. For some hazardous air pollutants, hazardous waste feedrate control of metals and chlorine was identified as the sole component of floor control (*i.e.*, where the best performing existing sources do not use pollution control equipment to remove the hazardous air pollutant). Examples include mercury and total chlorine from cement kilns. For other hazardous air pollutants, we identified hazardous waste feedrate control of metals and chlorine as a partial component of MACT floor control (*e.g.*, floor control for semivolatile metals include good particulate matter control in addition to feedrate control of semivolatile metals in hazardous waste).

In the May 1997 NODA, we continued to consider hazardous waste feedrate control of metals and chlorine as a valid floor control technology. However, rather than defining a specific MACT control feedrate level (expressed as a MTEC), we instead relied on another analysis tool, an emissions breakpoint analysis, to identify sources feeding metals and/or chlorine at high (and not MACT) levels. At the time, we believed that the breakpoint analysis was a less problematic approach to identify sources using MACT floor control than the approaches proposed initially.[62]

Given commenters' subsequent concerns with the emissions breakpoint analysis as well (see discussion in Section C below), we conclude that specifying MTECs as MACT control (partially or solely) is necessary to properly reflect the feedrate component of MACT control.

Notwithstanding how the MACT floor MTEC is defined, many commenters suggest that our consideration of hazardous waste feedrate as a floor control technique is inappropriate in a technology-based rulemaking and not permissible under the CAA. Commenters also state that hazardous waste feedrate control is not a control technique due to the wide variations in metals and chlorine in the hazardous waste generated at a single facility location. Further, they believe even greater variations occur in metals and chlorine levels in the hazardous waste generated at multiple production sites representing different industrial sectors. Thus, commenters suggest that basing a floor emission level on data from sources that feed hazardous waste with low levels of metals or chlorine is tantamount to declaring that wastes with higher levels of metals or chlorine are not to be generated. Other

[60] See 61 FR at 17366.

[61] We developed a term, Maximum Theoretical Emissions Concentration, to compare metals and chlorine feedrates across sources of different sizes. MTEC is defined as the metals or chlorine feedrate divided by the gas flow rate, and is expressed in µg/dscm.

[62] Comments had objected to our proposed approach of defining MTECs as too reliant on engineering inspection of the data.

commenters note, however, that hazardous waste feedrate control must be considered as a floor control technique because feedrate control is being used as a control means to comply with existing RCRA regulations for these combustors. Still other commenters recommend that we establish uniform hazardous waste feedrate limits (*i.e.*, base the standard on an emission concentration coupled with a hazardous waste feedrate limit on metals and chlorine) across all three hazardous waste combustor source categories. Please refer to Part Five, Section VII.D.3.c.iv of today's preamble and the Comment Response Document for detailed responses to these comments.

We do not accept the argument that control of hazardous waste metals and chlorine levels in hazardous waste cannot be part of the floor technology. First, control of hazardous air pollutants in hazardous waste feedstock(s) can be part of a MACT standard under section 112(d)(2)(A), which clearly indicates that material substitution can be part of MACT. Second, hazardous waste combustors are presently controlling the level of metal hazardous air pollutants and chlorine in the hazardous waste combusted because of RCRA regulatory requirements. (See § 266.103(c)(1) and (j) where metal and chlorine feedrate controls are required, and where monitoring of feedrates are required.) Simply because these existing controls are risk-based, rather than technology-based, does not mean that they are not means of controlling air emissions cognizable under the CAA. Floor standards are to be based on ''emission limitation[s]'' achieved by the best existing sources. An ''emission limitation'' includes ''a requirement established by the * * * Administrator which limits the quantity, rate, or concentration of emissions. * * * including any requirement relating to the operation * * * of a source. * * *'' CAA section 302(k). This is precisely what current regulations require to control metal and chlorine levels in hazardous waste feed.

Commenters also note that contemplated floor levels were lower than the feed limits specified in current regulations for boilers and industrial furnaces. This is true, but not an impediment to identifying achievable MACT floor levels. Actual performance levels can serve as a basis for a floor. An analogy would be where a group of facilities achieve better capture efficiency from air pollution control devices than required by existing rule. That level of performance (if generally achievable) can serve as the basis for a floor standard. Accordingly, we use hazardous waste feedrate, entirely or partially, to determine floor levels and beyond-the-floor levels for mercury, semivolatile metals, low volatile metals, and total chlorine.

iii. How Are Feedrate and Emissions Levels Representative of MACT Floor Control Identified? After identifying feedrate control as floor control, we use a data analysis method called the ''aggregate feedrate approach'' to establish floor control hazardous waste feedrate levels and emission levels for mercury, semivolatile metals, low volatile metals, and total chlorine. The first step in the aggregate feedrate approach is to identify an appropriate level of aggregated mercury, semivolatile metals, low volatile metals, and total chlorine feedrate control, expressed as a MTEC, being achieved in practice by the best performing incinerator, cement kiln and lightweight aggregate kiln sources. This aggregate MTEC level is derived only from the sources using MACT floor emission controls.

The aggregate feedrate approach involves four steps: (1) Identifying test conditions in the data base where data are available to calculate hazardous waste feedrate MTECs for all three metal hazardous air pollutant groups and total chlorine; (2) screening out test conditions where a source was not using the MACT floor emission control device for hazardous air pollutants that are cocontrolled by an air pollution control device [63]; (3) ranking the individual hazardous air pollutant MTECs, from the different source test conditions, from lowest to highest and assigning each a numerical rank, with a rank of one being the lowest MTEC; and (4) summing, for each test condition, the individual ranking for each of the hazardous air pollutants to determine a composite ranking. The total sum is used to provide an overall assessment of the aggregate level of hazardous air pollutants in the hazardous waste for each test condition. The hazardous waste feed streams with lower total sums (*i.e.*, hazardous air pollutant levels) are ''cleaner'' in aggregate than those with higher total sums.[64] (See the technical support document for more details on this procedure.[65])

The aggregate MTEC ranking process results in aggregate feedrate data from nine incinerators, 10 cement kilns, and 10 lightweight aggregate kilns from which to select an appropriate level of feedrate control representative of MACT floor control.[66] We considered selecting the source with either the highest or lowest aggregate MTEC in each source category to represent MACT floor control, but did not believe this was appropriate based on concerns about representativeness and achievability. We conclude that it is reasonable, however, to consider the best 50% of the sources for which we have data in each source category as the best performing sources. This is because, for incinerators and cement kilns, we have only a few sources with complete aggregate MTEC data relative to the size of the source category. The best 50% of the sources for these categories equates to five sources, given that we have aggregate MTEC data for nine incinerators and 10 cement kilns. For lightweight aggregate kilns, this equates also to five sources given that we have aggregate MTEC data for 10 lightweight aggregate kiln sources.

Additionally, we conclude it is appropriate to identify a feedrate MTEC representative of floor control based on the median of the best performing five sources. In selecting a representative sample and identifying the appropriate MTEC floor control level, we draw guidance from section 112(d)(3)(B), in which Congress requires the Agency to use the average of the best performing five sources when faced with small source categories (*i.e.*, less than 30 sources), and therefore limited data, to establish a MACT floor. In addition, this methodology is reasonable and appropriate because it allows consideration of a number of best performing sources (*i.e.*, five), which is within the range of reasonable values we could have selected.

We considered an approach that selected both the control technique and level of control as the average of the best performing 12% of incinerator and

[63] For example, to potentially be considered a MACT-controlled incinerator with respect to both the emissions control device and hazardous waste metals and chlorine feedrate, the incinerator must use a wet scrubber for hydrochloric acid and mercury control and must use either a fabric filter, ionizing wet scrubber, or electrostatic precipitator *and* achieve the floor particulate matter level of 0.015 gr/dscf. Similarly, cement kilns must achieve the particulate matter MACT floor (for this analysis only, the New Source Performance Standard was converted to an estimated equivalent stack gas concentration of 0.03 gr/dscf) and lightweight aggregate kilns must meet the particulate matter MACT floor of 0.025 gr/dscf. There is no MACT floor hydrochloric acid emissions control device for cement kilns and lightweight aggregate kilns.

[64] This aggregate hazardous waste MTEC ranking is done separately for each of the three combustor source categories.

[65] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

[66] Only nine incinerators were ultimately used because (1) We have complete metal emissions data on relatively few sources, and (2) many sources do not use particulate matter floor control, a major means of controlling semivolatile metals and low volatile metals.

cement kiln sources for which we have aggregate MTEC data. This approach resulted in using only the best single source as representative of MACT floor control for all existing sources because there are only nine incinerators and 10 cement kilns for which we have adequate aggregate data. However, the level of feedrate control achieved by the single best performing existing source is likely not representative of the range of higher feedrate levels achieved by the best performing existing sources and, indeed, would inappropriately establish as a floor what amounts to a new source standard.

The final step of the aggregate feedrate approach is to determine an emission level that is routinely achieved by sources using MACT floor control(s). Similar to the April 1996 NPRM and May 1997 NODA, we evaluated all available data for each test condition to determine if a hazardous air pollutant is fed at levels at or below the MACT floor control MTEC. If so, the test condition is added to the expanded MACT pool for that hazardous air pollutant.[67] We then define the floor emission level for the hazardous air pollutant/hazardous air pollutant group as the level achieved by the source with the highest emissions average in the MACT expanded pool.

The aggregate feedrate approach is a logical and reasonable outgrowth of the aggregate hazardous air pollutant approach to establish floor emission levels that we discussed in the April 1996 NPRM. The initial proposal determined MACT floors separately for each hazardous air pollutant controlled by a different control technology, but we also proposed an alternative whereby floors would be set on the basis of a source's performance for all hazardous air pollutants.

Many commenters prefer the total aggregate hazardous air pollutant approach over the individual hazardous air pollutant approach because it better ensures that floor levels would be simultaneously achievable. However, we reject the total aggregate approach because it tends to result in floors that are likely to be artificially high, reflective of limited emissions data for all hazardous air pollutants at each facility. These floor levels, therefore, would not reflect performances of the best performing sources for particular hazardous air pollutants. We are assured of simultaneous achievability in our final methodology by: (1) Establishing the MACT floor feedrate control levels on an aggregate basis for metals and chlorine, as discussed above, rather than for each individual hazardous air pollutant; (2) using the particulate matter MACT pool to establish floor levels for particulate matter, semivolatile metals, and low volatile metals; and (3) ensuring that floor controls are not technically incompatible. In fact, our resulting floor emission levels are already achieved in practice by 9 to 40 percent of sources in each of the three source categories, clearly indicating simultaneously achievable standards.[68]

C. What Other Floor Methodologies Were Considered?

This is a brief overview of the major features of the MACT floor methodologies that we proposed in the April 1996 NPRM or discussed in the May 1997 NODA, accompanied by our rationale for not pursuing those methodologies in this final rule.

1. April 19, 1996 Proposal

We proposed the same general approach to identify floor control and floor emission levels as used in today's final rule. The proposal contained an approach to identify the controls used by the best performing sources (*i.e.*, the MACT pool) and then identify an emission level that those controls are achieving. To identify the floor emission level, we considered emissions from all sources using properly designed and operated controls (*i.e.*, the expanded MACT pool) and established a preliminary floor level as the highest test condition average for those sources.

There are three major differences between the proposed approach and today's final approach, however:

a. Emissions Variability. At proposal, we added a statistically-derived emissions variability factor to the highest test condition average in the expanded MACT pool. Today we conclude that emissions variability is considered inherently in the floor methodology. (See discussion in section D below for our rationale for not using a statistically-derived variability factor.)

b. MACT Pool for Particulate Matter, Semivolatile Metals, and Low Volatile Metals. At proposal, we identified separate and different MACT pools (and associated MACT controls) for particulate matter, semivolatile metals, and low volatile metals, even though all three are controlled by a particulate matter control device. Commenters said this is inappropriate and we concur. Specifying the MACT floor particulate matter emission control device individually for these pollutants is likely to result in three different definitions of floor control. Thus, the same particulate matter control device would need to meet three different design specifications. As a practical matter, the more stringent specification would prevail. But, this highlights the impracticability of evaluating floor emission control for these standards individually rather than in the aggregate.

As discussed in the May 1997 NODA, today's approach uses the same initial MACT pool to establish the floor levels for particulate matter, semivolatile metals, and low volatile metals. The initial MACT pool is comprised of those sources meeting the emission control component of MACT control. To establish the semivolatile metal and low volatile metal floor levels, the particulate matter MACT pool is then analyzed to consider MACT hazardous waste feedrate control first for semivolatile metals and then for low volatile metals, using the aggregate feedrate approach discussed above.

c. Definition of MACT Control. At proposal, we defined MACT emissions control by specifying the design of the emissions control device. Commenters suggested that this was problematic because: (1) Our data base had limited data on design of the control device; (2) some of our available data were incorrect; and (3) the parameters the Agency was using to characterize MACT control did not adequately correlate with control efficiency. Given these concerns, our May 1997 NODA contained an emissions breakpoint approach to identify those sources that appeared to have anomalously higher emissions than other sources in the potential MACT pool. Our rationale was that given the anomalously high emissions, those sources were not, in fact, using MACT control.

Commenters express serious concerns about the validity of the nonstatistical approach used to identify the breakpoint. After considering various statistical approaches to identify an emissions breakpoint, we conclude that the emissions breakpoint approach is problematic.[69] For these reasons, we are

[67] The expanded MACT pool for each hazardous air pollutant is comprised of test conditions from sources equipped with the prescribed MACT floor emission control device, if any, and feeding hazardous waste at an MTEC not exceeding the MACT floor MTEC for that hazardous air pollutant.

[68] Our analysis shows that approximately nine percent of incinerators, 27 percent of cement kilns, and 40 percent of lightweight aggregate kilns currently operating can meet all of the floor levels simultaneously. See USEPA, ''Final Technical Support Document For HWC MACT Standards, Volume V: Emissions Estimates and Engineering Costs,'' July 1999.

[69] To improve the rigor of our breakpoint approach, we investigated a modified Rosner ''outlier'' test that: (1) Uses a single tailed test to consider only high ''outliers'' (*i.e.*, test conditions

not defining MACT emissions control by design parameters or using an emissions breakpoint approach to identify MACT emissions or feedrate control. Rather, the MACT floor emission control equipment, where applicable, is defined generically (*e.g.*, electrostatic precipitator, fabric filter), and the aggregate feedrate approach is used to define MACT floor feedrates. We believe the aggregate feedrate approach addresses the concerns that commenters raise on the proposed approach because it more clearly defines MACT control and relies less on engineering judgment.

2. May 1997 NODA

We have incorporated into the final rule several of the procedures discussed in the May 1997 NODA. The NODA explained why it is inappropriate to add a statistically-derived emissions variability factor to the highest test condition average of the expanded MACT pool. Despite comments to the contrary, we conclude that emissions variability is inherently considered in the floor methodology. See discussion in section D below.

In addition, the NODA discussed using the same initial MACT pool to establish the floor levels for particulate matter, semivolatile metals, and low volatile metals. We use this same approach in this final rule. Commenters generally concurred with that approach.

As discussed above, we considered using an emissions breakpoint technique, but conclude that this approach is problematic and did not use the approach for this rule.

D. How Is Emissions Variability Accounted for in Development of Standards?

The methodology we use to establish the final MACT emission standards intrinsically accounts for emissions variability without adding statistically-derived emissions variability factors. Many commenters strongly suggest that statistically-derived emissions variability factors must be added to the emission levels we identify from the data base as floor emission levels to ensure that the standards are routinely achievable.[70] Other commenters suggest that our floor methodology inherently accounts for emissions variability. We discuss below the types of emissions variability and why we conclude that emissions variability is inherently accounted for by our methodology.

We account for three types of emissions variability in establishing MACT standards: (1) Within test condition variability among test runs (a test condition is comprised of at least three runs that are averaged); (2) imprecision in the stack test method; and (3) source-to-source emissions variability attributable to source-specific factors affecting the performance of the same MACT control device. (See, *e.g. FMC Corp.* v. *Train,* 539 F.2d 973, 985–86 (4th Cir. 1976), holding that variability in performance must be considered when ascertaining whether a technology-based standard is achievable.) The following sections discuss the way in which we account for these types of variability in the final rule.

1. How Is Within-Test Condition Emissions Variability Addressed?

Inherent process variability will cause emissions to vary from run-to-run within a test condition, even if the stack method is 100 percent precise and even though the source is attempting to maintain constant operating conditions. This is caused by many factors including: Minor changes in the feedrate of feedstreams; combustion perturbations (*e.g.*, uncontrollable, minor fluctuations in combustion temperature or fan velocity); changes in the collection efficiency of the emission control device caused by fluctuations in key parameters (*e.g.*, power input to an electrostatic precipitator); and changes in emissions of materials (*e.g.*, sulfur dioxide) that may cause test method interferences.

At proposal, we used a statistical approach to account for emissions variability. See 61 FR at 17366. The statistical approach identified an emissions variability factor, which was added to the log-mean of the emission level being achieved based on the available ''short-term'' compliance test data. We called this emission level the ''design level.'' The variability factor was calculated to ensure that the design level could be achieved 99 percent of the time, assuming average within-test condition emissions variability for the source using MACT control.

In the May 1997 NODA, we discussed alternative emission standards developed without using a statistically-derived variability factor. Adding such a variability factor was determined inappropriate because it sometimes resulted in nonsensical results. For example, the particulate matter MACT floor level for incinerators under one floor methodology would have been higher than the current RCRA standard allows, simply due to the impact of an added variability factor. In other cases, the floor levels would have been much higher than our experience would indicate are routinely being achieved using MACT control. We reasoned that these inappropriate and illogical results may flow from either the data base used to derive the variability factor (*e.g.*, we did not have adequate information to screen out potentially outlier runs on a technical basis) or selecting an inappropriate floor-setting test condition as the design level (*e.g.*, we did not have adequate information on design, operation, and maintenance of emissions control equipment used by sources in the emissions data base to definitively specify MACT control).

Consequently, we reasoned that adequately accounting for within test condition emissions variability is achieved where relatively large data sets are available to evaluate for identifying the floor level. Large sets of emissions data from MACT sources, which have emissions below the floor level, are likely to represent the range of emissions variability. For small data sets (*e.g.*, dioxin/furan emissions for waste heat recovery boiler equipped incinerators; dioxin/furan emissions data for lightweight aggregate kilns), we acknowledged that the same logic would not apply. For these small data sets, the floor level was set at the highest run for the MACT source with the highest test condition average emissions. Many commenters suggest that our logic was flawed. Commenters say that, if we desire the floor level to be achievable 99 percent of the time (*i.e.*, the basis for the statistically-derived variability factor at proposal), the emissions data base is far too small to identify the floor level as the highest test condition average for sources using MACT control.

We conclude, however, that the final floor levels identified, using the procedures discussed above (*i.e.*, without adding a statistically-derived emissions variability factor), are levels that can be consistently achieved by well designed, operated, and maintained MACT sources. We

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that anomalously high emissions, not necessarily true outliers in the statistical sense); (2) presumes that any potential ''outliers'' are at the 80th percentile value or higher; and (3) has a confidence level of 90 percent. We abandoned this statistical approach because: (1) Although modifications to the standard Rosner test were supportable, the modified test has not been peer-reviewed; (2) although the target confidence level was 90 percent, the true significance level of the test, as revised, is inappropriately low—approximately 80 percent; and (3) the ''outlier'' test does not identify MACT-like test conditions because it only identifies anomalously high test conditions rather than the best performing test conditions.

[70] One commenter recommends specific statistical approaches to calculate variability factors and provides examples of how the statistical methods should be applied to our emissions data base. See comment number CS4A–00041.

conclude this because our emissions data base is comprised of compliance test data generated when sources have an incentive to operate under worst case conditions (*e.g.*, spiking metals and chlorine in the waste feed; detuning the emissions control equipment). Sources choose to operate under worst case conditions during compliance testing because the current RCRA regulations require that limits on key operating parameters not exceed the values occurring during the trial burn. Therefore, these sources conduct tests in a manner that will establish a wide envelope for their operating parameter limits in order to accommodate the expected variability (*e.g.*, variability in types of wastes, combustion system parameters, and emission control parameters). See 56 FR at 7146 where EPA likewise noted that certain RCRA operating permit test conditions are to be ''representative of worst-case operating conditions'' to achieve needed operating flexibility. One company that operates several hazardous waste incinerators at three locations comments that, because of the current RCRA compliance regime, which is virtually identical to the compliance procedures of today's MACT rule, ''the result is that units must be tested at rates which are at least three standard deviations harsher than normal operations and normal variability in order to simulate most of the statistical likelihood of allowable emission rates.'' [71] The commenter also states that because of the consequences of exceeding an operating parameter limit under MACT, ''* * * clearly a source will test under the worst possible operating conditions in order to minimize future (exceedances of the limits).'' Finally, the commenter says that ''Because of variability and the stiff consequences of exceeding these limits, operators do not in fact operate their units anywhere near the limits for sustained periods of time, but instead tend to operate several standard deviations below them, or at about 33 to 50% of the limits.'' [72]

We conclude from these comments, which are consistent with engineering principles and with many discussions with experts from the regulated community, that MACT sources with compliance test emissions at or below the selected floor level are achieving those levels routinely because these test conditions are worst-case and are defined by the source itself to ensure 100 percent compliance with the relevant standard.

We acknowledge, however, that mercury is a special case because our mercury emission data may not be representative of worst-case conditions. As discussed in Section I.B.3 above, sources did not generally spike mercury emissions during RCRA compliance testing because they normally feed mercury at levels resulting in emissions well below current limits.[73] Although our data base for mercury is comprised essentially of normal emissions, emissions variability is adequately accounted for in setting floor levels. First, mercury emissions variability is minimal because the source can readily control emissions by controlling the feedrate of mercury.[74] For cement and lightweight aggregate kilns, mercury is controlled solely by controlling feedrate. Given that there is no emission control device that could have perturbations affecting emission rates, emissions variability at a given level of mercury feedrate control is relatively minor. Any variability is attributable to variability in feedrate levels due to feedstream sampling and analysis imprecision, and stack method imprecision (see discussion below).

Second, our emissions data indicate that the mercury floor levels are being achieved by a wide margin, which is a strong indication that a variability factor is not needed. Only one of the 15 incinerators using MACT floor control exceeds the design level for the floor emission level.[75] In addition, only seven of 45 incinerators for which we have mercury emissions data exceed the design level, and two of those eight are know to have spiked mercury in the hazardous waste feed during compliance testing. Only six of the 45 incinerators exceed the floor emission level.

The situation is similar for cement kilns and lightweight aggregate kilns. Only two of 22 cement kilns using floor control exceed the design level, only five of the 33 kilns in the source category exceed the design level, and only one of the 33 kilns exceeds the floor emission level. Only one of nine lightweight aggregate kilns using floor control exceeds the design level, and only two of the 10 kilns in the source category exceed the design level (and one of those kilns is known to have spiked mercury in the hazardous waste feed during compliance testing). Only one of the 10 kilns exceeds the floor emission level, and that kiln spiked mercury.

We conclude from this analysis that the mercury floor emission levels in this rule are readily achieved in practice even though our mercury emissions data were not spiked (*i.e.*, they may not represent worst-case emissions), and therefore a separate variability factor is not needed.

2. How Is Waste Imprecision in the Stack Test Method Addressed?

Method precision is a measure of how closely emissions data are grouped together when measuring the same level of stack emissions (*e.g.*, using a paired or quad test train). Method imprecision is largely a function of the ability of the sampling crew and analytical laboratory to routinely follow best practices. Precision can be affected by: (1) Measurement of ancillary parameters including gas flow rate, pressure, and temperature; (2) recovery of materials from the sampling train; and (3) cleaning, concentrating, and quantitating the analyte.

Several commenters state that we must add a factor to the selected floor level to account for method imprecision in addition to a factor to account for within-test condition emissions variability. We investigated the imprecision for the stack methods used to document compliance with today's rule and determined that method imprecision may be significant for some hazardous air pollutant/method combinations.[76] Our results indicate, however, that method precision is much better than commenters claim, and that as additional data sets become available,

[71] See Comment No. CS4A–00029.A, dated August 16, 1996.

[72] To estimate the compliance cost of today's rule, we assumed that sources would design their systems to meet an emission level that is 70% of the standard, herein after called the ''design level.''

[73] Three of 23 incenerators used to define MACT floor (*i.e.*, sources for which mercury feedrate data are available) are known to have spiked mercury. No cement kilns used to define MACT floor (*e.g.*, excluding sources that have stopped burning hazardous waste) are known to have spiked mercury. Only one of ten lightweight aggregate kilns used to define MACT floor is known to have spiked mercury.

[74] Although incenerators are generally equipped with wet scrubbers that can have a mercury removal efficiency of 15 to 60 percent, feedrate control is nonetheless the primary means of mercury emissions control because of the relatively low removal efficiency provided by wet scrubbers.

[75] Commenters note that the mercury levels fed during RCRA compliance testing may not represent the normal range of feedrates, and thus the compliance test emission levels may not be representative of emission levels achieved in practice. Given that only one of 15 incinerators using floor control exceeds the design level, it appears that the floor emission level is, in fact, being achieved in practice. Some of these 15 sources were likely feeding mercury at the high end of their normal range, even though others may have been feeding mercury at normal or below normal levels. This is also the situation of cement kilns where only two of 2 kilns using floor control exceed the design level, and for lightweight aggregate kilns where only one of nine kilns using floor exceeds the design level.

[76] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

the statistically-derived precision bars for certain pollutants are reasonably expected to be reduced significantly. This is mainly because data should become available over a wider range of emission levels thus reducing the uncertainty that currently results in large precision bar projections for some hazardous air pollutants at emission levels that are not close to the currently available paired and quad-train emissions data.

We conclude that method imprecision, in selecting the floor levels for hazardous waste combustors, is adequately addressed for the same reasons that we accounted for within-test condition emissions variability. Method precision is simply a factor that contributes to within-test condition variability. As discussed above, sources consider emissions variability when defining their compliance test operating conditions to balance emissions standards compliance demonstrations with the need to obtain a wide operating envelope of operating parameter limits.

3. How Is Source-to-Source Emissions Variability Addressed?

If the same MACT control device (*i.e.*, same design, operating, and maintenance features) were used at several sources within a source category, emissions of hazardous air pollutants from the sources could vary. This is because factors that affect the performance of the control device could vary from source to source. Even though a device has the same nominal design, operating, and maintenance features, those features could never be duplicated exactly. Thus, emissions could vary from source to source.

We agree that this type of emissions variability must be accounted for in the standards to ensure the standards are achieved in practice. Source-to-source emissions variability is addressed by identifying the floor emission level as the highest test condition average for sources in the expanded MACT pool, as discussed above.[77]

The test condition average emissions for sources in the expanded MACT pool for most standards often vary over several orders of magnitude. That variability is attributable partially to the type of source-to-source emissions variability addressed here as well as the inclusion of sources with varying levels of MACT control in the pool. Sources are included in the expanded MACT pool if they have controls equivalent to or better than MACT floor controls. We are unable to identify true source-to-source emissions variability for sources that actually have the same MACT controls because we are unable to specify in sufficient detail the design, operating, and maintenance characteristics of MACT control. Such information is not readily available. Therefore, we define MACT control only in general terms. This problem (and others) are addressed in today's rule by selecting the MACT floor level based on the highest test condition average in the expanded MACT pool, which accounts for source-to-source variability.

We also conclude that the characteristics of the emissions data base coupled with the methodology used to identify the floor emission level adequately accounts for emissions variability so that the floor level is routinely achieved in practice by sources using floor control. As further evidence, we note that a large fraction—50 to 100 percent—of sources in the data base currently meet the floor levels regardless of whether they currently use floor control.[78]

VI. What Are the Standards for Existing and New Incinerators?

A. To Which Incinerators Do Today's Standards Apply?

The standards promulgated today apply to each existing, reconstructed, and newly constructed incinerator (as defined in 40 CFR 260.10) burning hazardous waste. These standards apply to all major source and area source incinerator units and to all units whether they are transportable or fixed sources. These standards also apply to incinerators now exempt from RCRA stack emission standards under §§ 264.340(b) and (c).[79] Additionally, these standards apply to thermal desorbers that meet the definition of a RCRA incinerator, and therefore, are not regulated under subpart X of part 264.

B. What Subcategorization Options Did We Evaluate?

We considered whether it would be appropriate to subcategorize incinerators based on several factors discussed below and conclude that subcategorization is not necessary. However, for waste heat recovery boiler-equipped incinerators, we establish a separate emission standard solely for dioxin/furan. We explained our rationale for separate dioxin/furan standards for waste heat recovery boilers in the May 1997 NODA (62 FR 24220). We said that waste heat recovery boilers emit significantly higher dioxin/furan emissions than other incinerators, probably because the heat recovery boiler precludes rapid temperature quench of the combustion gases to below 400°F, therefore warranting separate standards for dioxin/furan only (*i.e.*, the waste heat boiler does not affect achievability of the other emission standards).

We considered several options for subcategorizing the hazardous waste incinerator source category based on: (1) Size of the unit (*e.g.*, small and large incinerators); (2) method of use of the hazardous waste incinerator (*e.g.*, commercial hazardous waste incinerator, captive (on-site) unit); (3) facility design (*e.g.*, rotary kiln, liquid injection, fluidized bed, waste heat boiler), and (4) type of waste fed (*e.g.*, hazardous waste mixed with radioactive waste, munitions, liquid, solid or aqueous wastes). Subcategorization would be appropriate if one or more of these factors affected achievability of emission standards that were established without subcategorization. In the May 1997 NODA (62 FR 24219), we stated that subdividing the hazardous waste incinerator source category by size or method of use (such as commercial or on-site) would be inappropriate because it would not result in standards that are more achievable. Many of the standards would be the same for the subcategories while the remainder would be more stringent. That conclusion is not altered by any of the changes in today's final rule. Therefore, subcategorization would add complexity without any tangible achievability benefits.

In the same notice, we also requested comment on subcategorization and/or a deferral of standards for mixed waste incinerators based on a comment from the Department of Energy that this type of incinerator has several unique features that warrant subcategorization.

[77] Because of the need to account for this type of variability, we disagree with those commenters recommending that: (1) The floor emission level be identified as the average emission level achieved by the 12 percent of source with the lowest emissions; and (2) it is inappropriate to base the floor emission level on sources using floor control but that are not within the 12 percent of sources with the lowest emissions (*i.e.*, the expanded MACT pool should not be used to identify floor emission levels). The floor emission level must be achieved in practice by sources using the appropriately designed and operated floor control. Thus, emission levels being achieved by all sources using the appropriately designed and operated floor control (*i.e.*, including sources using floor control but having emission levels greater than the average of the emissions achieved by the 12 percent of sources with the lowest emissions) must be considered when identifying the floor emission level.

[78] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

[79] Sections 264.340(b) and (c) exempt from stack emission standards incinerators (a) burning solely ignitable, corrosive or reactive wastes under certain conditions, and (b) if the waste contains no or insignificant levels of hazardous constituents.

There are three Department of Energy mixed waste incinerators. Each mixed waste incinerator has a different type of operation and different air pollution control devices, and two of the sources have high dioxin/furan and mercury emissions (several times the dioxin/furan standards adopted in today's rule). We received several comments on the mixed waste incinerator issue. These commenters contend that, because of the radioactive component of the wastes, mixed waste incinerators pose greater than average risk, and regulating these facilities should not be deferred. These commenters also note that the MACT controls are not incompatible with mixed waste incinerators and thus these incinerators can readily achieve the emission standards. We agree that MACT controls are compatible with mixed waste incinerators, with one exception discussed below, and do not establish a mixed waste incinerator subcategory.

The standards promulgated today are generally achievable by all types and sizes of incinerators when using MACT controls. We recognize, however, that each of the possible subcategories considered has some unique features. At the same time, upon consideration of each individual issue, we conclude that unique features of a particular hazardous waste incinerator can be better dealt with on an individual basis (through the permit process or through petitions) instead of through extensive subcategorization. As an example, we agree with the Department of Energy's contentions that feedstream testing for metals is problematic for mixed waste incinerators due to radioactivity of the waste and because risk from metal emissions is minimal in mixed waste incinerators that use HEPA filters to prevent radioactive emissions. Section 63.1209(g)(1) of today's rule provides a mechanism for petitioning the Administrator for use of an alternative monitoring method.[80] This petition process appears to be an appropriate vehicle for addressing the concerns expressed by the Department of Energy about feedstream testing for metals and use of HEPA filters at its mixed waste incinerators.

In summary, our decision not to subcategorize hazardous waste incinerators is based on four reasons:

(1) Size differences among hazardous waste incinerators do not necessarily reflect process, equipment or emissions differences among the incinerators. Many small size hazardous waste incinerators have emissions lower than those promulgated today even though they are not regulated to those low levels.

(2) Types and concentrations of uncontrolled hazardous air pollutants are similar for all suggested subcategories of hazardous waste incinerators.

(3) The same type of control devices, such as electrostatic precipitators, fabric filters, and scrubbers, are used by all hazardous waste incinerators to control emissions of particular hazardous air pollutants.

(4) The standards are achievable by all types and sizes of well designed and operated incinerators using MACT controls.

C. What Are the Standards for New and Existing Incinerators?

1. What Are the Standards for Incinerators?

We discuss in this section the basis for the emissions standards for incinerators. The emissions standards are summarized below:

STANDARDS FOR EXISTING AND NEW INCINERATORS

Hazardous air pollutant or hazardous air pollutant surrogate	Emissions standard [1]	
	Existing sources	New sources
Dioxin /Furan	0.20 ng TEQ [2]/dscm; or 0.40 ng TEQ/dscm and temperature at inlet to the initial particulate matter control device ≤ 400°F.	0.20 ng TEQ/dscm.
Mercury	130 µg/dscm	45 µg/dscm.
Particulate Matter	34mg/dscm (0.015gr/dscf)	34mg/dscm (0.015gr/dscf).
Semivolatile Metals	240 µg/dscm	24 µg/dscm.
Low Volatile Metals	97 µg/dscm	97 µg/dscm.
Hydrochloric Acid/Chlorine Gas	77 ppmv	21 ppmv.
Hydrocarbons [3, 4]	10 ppmv (or 100 ppmv carbon monoxide)	10 ppmv (or 100 ppmv carbon monoxide).
Destruction and Removal Efficiency	99.99% for each specific principal organic hazardous constituent, except 99.9999% for specified dioxin-listed wastes.	Same as for existing incinerators.

[1] All emission levels are corrected to 7 percent oxygen.
[2] Toxicity equivalent quotient, the international method of relating the toxicity of various dioxin/furan congeners to the toxicity of 2,3,7,8–TCDD.
[3] Hourly rolling average. Hydrocarbons reported as propane.
[4] Incinerators that elect to continuously comply with the carbon monoxide standard must demonstrate compliance with the hydrocarbon standard of 10ppmv during the comprehensive performance test.

2. What Are the Standards for Dioxins and Furans?

We establish a dioxin/furan standard for existing incinerators of either 0.20 ng TEQ/dscm, or a combination of dioxin/furan emissions up to 0.40 ng TEQ/dscm and temperature at the inlet to the initial dry particulate matter control device not to exceed 400°F.[81] Expressing the standard as a temperature limit as well as a dioxin/furan concentration limit provides better control of dioxin/furan, because sources operating at temperatures below 400°F generally have lower emissions and is consistent with the current practice of many sources. Further, without the lower alternative TEQ limit of 0.20 ng/dscm, sources that may be operating dry particulate matter control devices at temperatures higher than 400°F while achieving dioxin/furan emissions below 0.20 ng TEQ/dscm would nonetheless be required to incur costs to lower gas temperatures. This would not be appropriate because lowering gas temperatures in this case would likely

[80] The petition for an alternative monitoring method should be included in the comprehensive performances test plan submitted for review and approval.

[81] Incinerators that use wet scrubbers as the initial particulate matter control device are presumed to meet the 400°F temperature requirement. Consequently, as a practical matter, the standard for such incinerators is simply 0.4 ng TEQ/dscm.

achieve limited reductions in dioxin/furan emissions (*i.e.*, because emissions are already below 0.20 ng TEQ).

For new incinerators, the dioxin/furan standard is 0.20 ng TEQ/dscm. We discuss below the rationale for these standards.

a. What is the MACT Floor for Existing Sources? We establish the same MACT floor control, as was evaluated in the May 1997 NODA, based on the revised data base and the refinements to the analytical approaches. This floor control is based on quenching of combustion gases to 400°F or below at the dry particulate matter control device.[82] We selected a temperature of 400°F because that temperature is below the temperature range for optimum surface-catalyzed dioxin/furan formation reactions—450°F to 650°F—and most sources operate their particulate matter control device below that temperature. In addition, temperature is an important control parameter because dioxin/furan emissions increase exponentially as combustion gas temperatures at the dry particulate matter control device increase above 400°F.

We identify a MACT floor level of 0.40 ng TEQ/dscm for incinerators other than those equipped with waste heat recovery boilers. As discussed in the May 1997 NODA, the floor level of 0.40 ng TEQ/dscm is based on the highest nonoutlier test condition for sources equipped with dry particulate matter control devices operated at temperatures of 400°F or below or wet particulate matter control devices. We screened out four test conditions from three facilities because they have anomalously high dioxin/furan emissions and are not representative of MACT control practices.[83] Three of these test conditions are from sources that had other test conditions with emission averages well below 0.40 ng TEQ/dscm, indicating that the same facilities can achieve lower emission levels in different operating modes.

We identify a MACT floor level for waste heat boiler-equipped hazardous waste incinerators of 12 ng TEQ/dscm based on the highest emitting individual run for sources equipped with dry particulate matter control devices operated at temperatures of 400°F or below or wet particulate matter control devices. We use the highest run to set the floor level rather than the average of the runs for the test condition to address emissions variability concerns given that we have a very small data set for waste heat boilers. All waste heat boiler-equipped hazardous waste incinerators meet this floor level, except for a new test conducted after the publication of the May 1997 NODA at high temperature conditions that resulted in dioxin/furan emission levels of 47 ng TEQ/dscm. This source is not using MACT control, however, because the temperature at the particulate matter control device exceeded 400°F. Thus, we do not consider emissions from this source in identifying the floor level.

We received numerous and diverse comments on the April 1996 proposal and the May 1997 NODA. While some commenters consider the dioxin/furan standards too high, a large number comment that the standards are too stringent. Many comment that the methodology used for calculating the dioxin/furan MACT floor level is inappropriate and that the cost-effectiveness of the standards is not reasonable. In particular, some commenters suggest separating ''fast quench'' and ''slow quench'' units. We have fully addressed this latter concern because we now establish separate dioxin/furan standards for waste heat boilers given that they are a fundamentally different type of process and that they have higher dioxin/furan emissions because of the slow quench across the boiler. We address the other comments elsewhere in the preamble and in the comment response document.

Approximately 65% of all test conditions at all incinerator sources are achieving the 0.40 ng TEQ/dscm level, and over 50% of all test conditions achieve the 0.20 ng TEQ/dscm level. We estimate that approximately 60 percent of incinerators currently meet the TEQ limit as well as the temperature limit. Under the statute, compliance costs are not to be considered in MACT floor determinations. For purposes of compliance with Executive Order 12866 and the Regulatory Flexibility Act, we calculated the annualized cost for hazardous waste incinerators to achieve the dioxin/furan MACT floor levels. Assuming that no hazardous waste incinerator exits the market due to MACT standards, the annual cost is estimated to be $3 million, and the standards will reduce dioxin/furan emissions nationally by 3.4 g TEQ per year from the baseline emissions level of 24.8 g TEQ per year.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? We investigated the use of activated carbon injection, along with limiting temperatures at the inlet to the initial dry particulate matter control device to 400°F,[84] to achieve two alternative beyond-the-floor emission levels: (1) 0.40 ng TEQ/dscm for waste heat boiler-equipped incinerators (*i.e.*, slow quench) to reduce their emissions to the floor level for other incinerators; and (2) 0.20 ng TEQ/dscm for all incinerators. Activated carbon injection technology is feasible and proven to reduce dioxin/furan emissions by 99 percent or greater.[85] It is currently used by one waste heat boiler-equipped hazardous waste incinerator (Waste Technologies Industries in East Liverpool, Ohio) and many municipal waste combustors.[86] The removal efficiency of an activated carbon injection system is affected by several factors including carbon injection rate and adsorption quality of the carbon. Thus, activated carbon injection systems can be used by waste heat boiler-equipped incinerators to achieve alternative beyond-the-floor emissions of either 0.40 ng TEQ/dscm or 0.20 ng TEQ/dscm.

We conclude that a beyond-the-floor emission level of 0.40 ng TEQ/dscm for waste heat boiler-equipped incinerators is cost-effective but a 0.20 ng TEQ/dscm emission level for all incinerators is not cost-effective. We estimate that 23 waste heat boiler-equipped incinerators will need to install activated carbon injection systems at an annualized cost of approximately $6.6 million. This will result in a sizable reduction of 17.9 g TEQ dioxin/furan emissions per year and will provide an 84 percent reduction in emissions from the floor emission level (21.4 g TEQ per year) for all hazardous waste incinerators. This represents a cost-effectiveness of $370,000 per gram TEQ removed.

When we evaluated the alternative beyond-the-floor emission level of 0.20 ng TEQ/dscm for all incinerators, we determined that 80 hazardous waste incinerators would incur costs to reduce dioxin/furan emissions by 19.5 g TEQ from the floor level (21.4 g TEQ) at an annualized cost of $16.1 million. The cost-effectiveness would be $827,000 per gram of TEQ removed. In addition,

[82] The temperature limit applies at the inlet to a dry particulate matter control device that suspends particulate matter in the combustion gas stream (*e.g.*, electrostatic precipitator, fabric filter) such that surface-catalyzed formation of dioxin/furan is enhanced. The temperature limit does not apply to a cyclone control device, for example.

[83] USEPA, ''Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999, Section 3.1.1.

[84] Limiting the temperature at the dry particulate matter control device reduces surface-catalyzed formation of dioxin/furan and enhances the adsorption of dioxin/furan on the activated carbon.

[85] USEPA, ''Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

[86] We have established in a separate rulemaking that activated carbon injection is MACT floor control for municipal waste combustors.

we determined that the vast majority of these emissions reductions would be provided by waste heat boiler-equipped incinerators, and would be provided by the beyond-the-floor emission level of 0.40 ng TEQ/dscm discussed above. The incremental annualized cost of the 0.20 ng TEQ/dscm option for incinerators other than waste heat boiler-equipped incinerators would be $9.5 million, and would result in an incremental reduction of only 1.6 g TEQ per year. This represents a high cost for a very small additional emission reduction from the floor, or a cost-effectiveness of $6.0 million per additional gram of TEQ dioxin/furan removed. Accordingly, we conclude that the 0.20 ng TEQ/dscm beyond-the-floor option is not cost-effective.

We note that dioxin/furan are some of the most toxic compounds known due to their bioaccumulative potential and wide range of adverse health effects, including carcinogenesis, at exceedingly low doses. We consider beyond-the-floor reduction of dioxin/furan emissions a prime environmental and human health consideration. As discussed above, our data base indicates that a small subset of incinerators—those equipped with waste heat recovery boilers—can emit high levels of dioxin/furan, up to 12 ng TEQ/dscm, even when operating the dry particulate matter control device at ≤400°F. We are concerned that such high dioxin/furan emission levels are not protective of human health and the environment, as mandated by RCRA. If dioxin/furan emissions from waste heat boiler-equipped incinerators are not reduced by a beyond-the-floor emission standard, omnibus RCRA permit conditions would likely be needed in many cases. This would defeat our objective of having only one permitting framework for stack air emissions at hazardous waste incinerators (except in unusual cases). Thus, the beyond-the-floor standard promulgated today for waste heat boiler-equipped incinerators is not only cost-effective, but also an efficient approach to meed the Agency's RCRA mandate.

Some commenters suggest that the standard for waste heat boiler-equipped hazardous waste incinerators, which is based on activated carbon injection, be set at levels achieved by activated carbon injection at the Waste Technologies Industries facility—an average of 0.07 ng TEQ/dscm. We determined that this would not be appropriate because of concerns that such a low emission level may not be routinely achievable. An emission level of 0.07 ng TEQ/dscm represents a 99.4 percent reduction in emissions from the floor level of 12 ng TEQ/dscm. Although activated carbon injection can achieve dioxin/furan emissions reductions of 99 percent and higher, we are concerned that removal efficiency may decrease at low dioxin/furan emission levels. We noted our uncertainty about how much activated carbon injection control efficiency may be reduced at low dioxin/furan concentrations in the May 1997 NODA (62 FR at 24220). Several commenters agree with our concern, including Waste Technologies Industries.[87] No commenters provide data or information to the contrary. Because we have data from only one hazardous waste incinerator documenting that an emission level of 0.07 ng TEQ can be achieved, we are concerned that an emission level that low may not be routinely achievable by all sources.

c. What Is the MACT Floor for New Sources? For new sources, the CAA requires that the MACT floor be the level of control used by the best controlled single source. As discussed above, one source, the Waste Technologies Industries (WTI) incinerator in Liverpool, Ohio, uses activated carbon injection. Therefore, we identify activated carbon injection as MACT floor control for new sources. To establish the MACT floor emission level that is being achieved in practice for sources using activated carbon injection, data are available from only WTI. WTI is achieving an emission level of 0.07 ng TEQ/dscm. As discussed above, we are concerned that emission level may not be routinely achievable because the removal efficiency of activated carbon injection may be reduced at such low emission levels. An emission level of 0.20 ng TEQ/dscm is routinely achievable, however. We note that activated carbon injection is MACT floor control for dioxin/furan at new large municipal waste combustors. We established a standard of 13 ng/dscm total mass ''equal to about 0.1 to 0.3 ng/dscm TEQ'' for these sources (60 FR 65396 (December 19, 1995)), equivalent to approximately 0.20 ng TEQ/dscm. We conclude, therefore, that a floor level of 0.20 ng TEQ/dscm is achievable for new sources using activated carbon injection and accordingly set this as the standard.

d. What Are Our Beyond-the-Floor Considerations for New Sources? As discussed in the May 1997 NODA, a beyond-the-floor standard below 0.20 ng TEQ/dscm would not be appropriate. Although installation of carbon beds would enable new hazardous waste incinerators to achieve lower dioxin/furan levels, we do not consider the technology to be cost-effective. The reduction in dioxin/furan emissions would be very small, while the costs of carbon beds would be prohibitively high. In addition, due to the very small dioxin/furan reduction, the benefit in terms of cancer risks reduced also will be very small. Therefore, we conclude that a beyond-the-floor standard for dioxin/furan is not appropriate.

3. What Are the Standards for Mercury?

We establish a mercury standard for existing and new incinerators of 130 and 45 μg/dscm respectively. We discuss below the rationale for these standards.

a. What Is the MACT Floor for Existing Sources? We are establishing the same MACT floor level as proposed, 130 μg/dscm although, as discussed below, the methodology underlying this standard has changed from proposal. At proposal, the floor standard was based on the performance of either: (1) Feedrate control of mercury at a maximum theoretical emission concentration not exceeding 19 μg/dscm; or (2) wet scrubbing in combination with feedrate control of mercury at a level equivalent to a maximum theoretical emission concentration not exceeding 51 μg/dscm. In the May 1997 NODA, we reevaluated the revised data base and defined MACT control as based on performance of wet scrubbing in combination with feedrate control of mercury at a level equivalent to a maximum theoretical emission concentration of 50 μg/dscm and discussed a floor level of 40 μg/dscm.

Several commenters object to our revised methodology and are concerned that we use low mercury feedrates to define floor control. These commenters state that standards should not be based on sources feeding very small amounts of a particular metal, but rather on their ability to minimize the emissions by removing the hazardous air pollutant. As discussed previously, we maintain that hazardous waste feedrate is an appropriate MACT control technique. We agree with commenters' concerns, however, that previous methodologies to define floor feedrate control may have identified sources feeding anomalously low levels of a metal (or chlorine). To address this concern, we have revised the floor determination methodology for mercury, semivolatile metals, low volatile metals and total chlorine. A

[87] Waste Technologies Industries suggested, however, that after experience with activated carbon injection systems has been attained by several hazardous waste incinerators, the Agency could then determine whether an emission level of 0.07 ng TEQ/dscm is routinely achievable. See comment number 064 in Docket F–97–CS4A–FFFFF.

detailed description of this methodology—the aggregate feedrate approach—is presented in Part Four, Section V of this preamble. Adopting this aggregate feedrate approach, we identify a mercury feedrate level that is approximately five times higher than the May 1997 NODA level and higher than approximately 70% of the test conditions in our data base.

Wet scrubbers also provide control of mercury (particularly mercury chlorides). Given that virtually all incinerators are equipped with wet scrubbers (for control of particulate matter or acid gases), we continue to define floor control as both hazardous waste feedrate control of mercury and wet scrubbing. The MACT floor based on the use of wet scrubbing and feedrate control of mercury is 130 µg/dscm.[88]

The floor level is being achieved by 80% of the test conditions in our data base of 30 hazardous waste incinerators. As already discussed above, consideration of costs to achieve MACT floor standards play no part in our MACT floor determinations, but we nevertheless estimate costs to the hazardous waste incinerator universe for administrative purposes. We estimate that 35 hazardous waste incinerators, assuming no market exit by any facility, will need to adopt measures to reduce mercury emissions at their facilities by 3.46 Mg from the current baseline of 4.4 Mg at an estimated annualized cost $12.2 million, yielding a cost-effectiveness of $3.6 million per Mg of mercury reduced.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? As required by statute, we evaluated more stringent beyond-the-floor controls for further reduction of mercury emissions from the floor level. Activated carbon injection systems can achieve mercury emission reductions of over 85 percent and we proposed them as beyond-the-floor control in the April 1996 NPRM. In the May 1997 NODA, we reevaluated the use of activated carbon injection[89] as beyond-the-floor control, but cited significant cost-effectiveness concerns. We reiterate these concerns here. Our technical support document[90] provides details of annualized costs and reductions that can be achieved.

In addition, we considered a beyond-the-floor level of 50 µg/dscm based on limiting the feedrate of mercury in the hazardous waste (*i.e.*, additional feedrate control beyond floor control), and conducted an evaluation of the cost of achieving this reduction to determine if this beyond-the-floor level would be appropriate. The national incremental annualized compliance cost to meet this beyond-the-floor level, rather than comply with the floor controls, would be approximately $4.2 million for the entire hazardous waste incinerator industry and would provide an incremental reduction in mercury emissions nationally beyond the MACT floor controls of 0.7 Mg/yr, yielding a cost-effectiveness of $10 million per additional Mg of mercury reduced. Thus, potential benefits in relation to costs are disproportionately low, and we conclude that beyond-the-floor mercury controls for hazardous waste incinerators are not warranted. Therefore, we are not adopting a mercury beyond-the-floor standard.

Many commenters object to our beyond-the-floor standards as proposed, citing high costs for achieving relatively small mercury emission reductions, and compare the cost-effectiveness numbers with regulations of other sources (electric utilities, municipal and medical waste incinerators). Although comparison between rules for different sources is not directly relevant (see, *e.g.*, *Portland Cement Association* v. *Ruckelshaus* 486 F.2d 375, 389 (D.C. Cir. 1973)), we nevertheless agree that the cost of a mercury beyond-the-floor standard in relation to benefits is substantial. Some commenters, as well as the peer review panel, state that beyond-the-floor levels are not supported by a need based on risk. Although the issue of residual risk can be deferred under the CAA, an immediate question must be addressed if RCRA regulation of air emissions is to be deferred. Our analysis[91] indicates that mercury emissions at the floor level do not pose a serious threat to the human health and environment and that these standards are adequately protective to satisfy RCRA requirements as a matter of national policy, subject, of course, to the possibility of omnibus permit conditions for individual facilities in appropriate cases.

Some commenters state that the technical performance of activated carbon injection for mercury control is not adequately proven. Activated carbon injection performance has been adequately demonstrated at several hazardous waste incinerators, municipal waste combustors, and other devices.[92] Our peer review panel also states that activated carbon injection can achieve 85% reduction of mercury emissions.[93] Some commenters also state that we underestimate the cost and complexities of retrofitting incinerators to install activated carbon injection systems (*e.g.*, air reheaters would be required in many cases). We reevaluated the modifications needed for retrofits of activated carbon injection systems and have revised the costs of installation.

c. What Is the MACT Floor for New Sources? Floor control must be based on the level of control used by the best controlled single source. The best controlled source in our data base uses wet scrubbing and hazardous waste feedrate control of mercury at a feedrate corresponding to a maximum theoretical emission concentration of 0.072 µg/dscm. We conclude that this feedrate is atypically low, however, given that the next lowest mercury feedrates in our data base are 63, 79, 110, and 130 µg/dscm, expressed as maximum theoretical emission concentrations. Accordingly, we select the mercury feedrate for the second best controlled source under the aggregate feedrate approach to represent the floor control mercury feedrate for new sources. That feedrate is 110 µg/dscm[94] expressed as a maximum theoretical emission concentration, and corresponds to an emission level of 45 µg/dscm after considering the expanded MACT pool (*i.e.*, the highest emission level from all sources using floor control). Therefore, we establish a MACT floor level for mercury for new sources of 45 µg/dscm.[95] We note that, at proposal and in

[88] This is coincidentally the same floor level as proposed, notwithstanding the use of a different methodology.

[89] Flue gas temperatures would be limited to 400°F at the point of carbon injection to enhance mercury removal.

[90] USEPA, ''Technical Support Document for HWC MACT Standards, Volume V: Emission Estimates and Engineering Costs,'' July 1999.

[91] USEPA, ''Risk Assessment Support to the Development of Technical Standards for Emissions from Combustion Units Burning Hazardous Wastes: Background Information Document,'' July 1999.

[92] USEPA, ''Technical Support Document for HWC MACT Standards, Volume III: Selection of Proposed MACT Standards and Technologies,'' July 1999.

[93] Memo from Mr. Shiva Garg, EPA to Docket No. F–96–RCSP–FFFFF entitled ''Peer Review Panel Report in support of proposed rule for revised standards for hazardous waste combustors'', dated August 5, 1996.

[94] The test conditions with mercury feedrates of 63 and 79 µg/dscm do not have complete data sets for all metals and chlorine. Thus, these conditions cannot be used under the aggregate feedrate approach to define the floor level of feedrate control. Mercury emissions from those test conditions are used, however, to identify a floor emission level that is being achieved.

[95] In addition, this floor emission level may be readily achievable for new sources using activated carbon injection as floor control for dioxin/furan without the need for feedrate control of mercury. Activated carbon injection can achieve mercury emissions reductions of 85 percent. Given that the upper bound mercury feedrate for ''normal'' wastes (*i.e.*, without mercury spiking) in our data base corresponds to a maximum theoretical emission concentration of 300 µg/dscm, such sources could

Continued

the May 1997 NODA, mercury standards of 50 and 40 µg/dscm respectively were proposed for new sources. Today's final rule is in the same range as those proposed emission levels.

d. What Are Our Beyond-the-Floor Considerations for New Sources? We evaluated the use of activated carbon injection as beyond-the-floor control for new sources to achieve emission levels lower than floor levels. In the April 1996 NPRM and May 1997 NODA, we stated that new sources could achieve a beyond-the-floor level of 4 µg/dscm based on use of activated carbon injection. We cited significant cost-effectiveness concerns at that level, however. We reiterate those concerns today.

Many commenters object to our beyond-the-floor standards as proposed, citing high costs for achieving relatively small mercury emission reductions. They compare the proposed standards unfavorably with other sources' regulations (*e.g.*, electric utilities, municipal and medical waste incinerators), where the cost-effectiveness values are much lower. As stated earlier, comparison between rules for different sources is not directly relevant. Nonetheless, we conclude that use of activated carbon injection as a beyond-the-floor control for mercury for new sources would not be cost-effective. We also note that the floor levels are adequately protective to satisfy RCRA requirements.

We also considered additional feedrate control of mercury as beyond-the-floor control. We conclude, however, that significant emission reductions using feedrate control may be problematic because the detection limit of routine feedstream analysis procedures for mercury is such that a beyond-the-floor mercury emission limit could be exceeded even though mercury is not present in feedstreams at detectable levels. Although sources could potentially perform more sophisticated mercury analyses, cost-effectiveness considerations would likely come into play and suggest that a beyond-the-floor standard is not warranted.

4. What Are the Standards for Particulate Matter?

We establish standards for existing and new incinerators which limit particulate matter emissions to 0.015 grains/dry standard cubic foot (gr/dscf) or 34 milligrams per dry standard cubic meter (mg/dscm).[96] We chose the particulate matter standard as a surrogate control for the metals antimony, cobalt, manganese, nickel, and selenium. We refer to these five metals as ''nonenumerated metals'' because standards specific to each metal have not been established. We discuss below the rationale for adopting these standards.

a. What Is the MACT Floor for Existing Sources? Our data base consists of particulate matter emissions from 75 hazardous waste incinerators that range from 0.0002 gr/dscf to 1.9 gr/dscf. Particle size distribution greatly affects the uncontrolled particulate matter emissions from hazardous waste incinerators, which, in turn, is affected by incinerator type and design, particulate matter entrainment rates, waste ash content, waste sooting potential and waste chlorine content. Final emissions from the stacks of hazardous waste incinerators are affected by the degree of control provided to uncontrolled particulate matter emissions by the air pollution control devices. Dry collection devices include fabric filters or electrostatic precipitators, while wet collection devices include conventional wet scrubbers (venturi type) or the newer patented scrubbers like hydrosonic, free jet, or the collision type. Newer hazardous waste incinerators now commonly use ionizing wet scrubbers or wet electrostatic precipitators or a combination of both dry and wet devices.

The MACT floor setting procedure involves defining MACT level of control based on air pollution control devices used by the best performing sources. Control devices used by these best performing sources can be expected to routinely and consistently achieve superior performance. Then, we identify an emissions level that well designed, well-operated and well-maintained MACT controls can achieve based on demonstrated performance, and engineering information and principles.

The average of the best performing 12 percent of hazardous waste incinerators use either fabric filters, electrostatic precipitators (dry or wet), or ionizing wet scrubbers (sometimes in combination with venturi, packed bed, or spray tower scrubbers). As explained in Part Four, Section V, we define floor control for particulate matter for incinerators as the use of a well-designed, operated, and maintained fabric filter, electrostatic precipitator, or ionizing wet scrubber. Sources using certain wet scrubbing techniques such as high energy venturi scrubbers, and novel condensation, free-jet, and collision scrubbers can also have very low particulate matter emission levels. We do not consider these devices to be MACT control, however, because, in general, a fabric filter, electrostatic precipitator, or ionizing wet scrubber will provide superior particulate matter control. In some cases, sources using medium or low energy wet scrubbers are achieving very low particulate matter emissions, but only for liquid waste incinerators, which typically have low ash content waste. Thus, this control technology demonstrates high effectiveness only under atypical conditions, and we do not consider it to be MACT floor control for particulate matter.

We conclude that fabric filters, electrostatic precipitators, and ionizing wet scrubbers are routinely achieving an emission level of 0.015 gr/dscf based upon the following considerations:

i. Sources in our data base are achieving this emission level. Over 75 percent of the sources in the expanded MACT pool are achieving an emission level of 0.015 gr/dscf. We investigated several sources in our data base using floor control but failing to achieve this level, and we found that the control devices do not appear to be well-designed, operated, and maintained. Some of these sources are not using superior fabric filter bags (*e.g.*, Gore-tex®, Nomex felt, or tri-lift fabrics), some exhibit salt carry-over and entrainment from a poorly operated wet scrubber located downstream of the fabric filter, and some are poorly maintained in critical aspects (such as fabric cleaning cycle or bag replacements).[97]

ii. Well-designed, operated, and maintained fabric filters and electrostatic precipitators can routinely achieve particulate matter levels lower than the floor level of 0.015 gr/dscf. Levels less than 0.005 gr/dscf were demonstrated on hazardous waste incinerators and municipal waste combustors in many cases. Well-designed fabric filters have a surface collection area of over 0.5 ft^2/acfm and high performance filter fabrics such as Nomex and Gore-tex. Well-designed electrostatic precipitators have advanced power system controls (with intermittent or pulse energization), internal plate and electrode geometry to

achieve the mercury floor emission level of 45 µg/dscm using activated carbon injection alone.

[96] Particulate matter is a surrogate for the metal hazardous air pollutants for which we are not establishing metal emission standards: Antimony, cobalt, manganese, nickel, and selenium.

[97] USEPA, ''Technical Support Document for HWC, MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

allow for high voltage potential, flue gas conditioning by addition of water or reagents such as sulfur trioxide or ammonia to condition particulate matter for lower resistivity, and optimized gas distribution within the electrostatic precipitator. The technical support document identifies many hazardous waste incinerators using such well designed control equipment.

iii. The 0.015 gr/dscf level is well within the accepted capabilities of today's particulate matter control devices in the market place. Vendors typically guarantee emission levels for the particulate matter floor control devices at less than 0.015 gr/dscf and in some cases, as low as 0.005 gr/dscf.

iv. The 0.015 gr/dscf level is consistent with standards promulgated for other incinerator source categories burning municipal solid waste and medical waste, both of which are based on performance of fabric filters or electrostatic precipitators as MACT. Comparison of hazardous waste incinerator floor level to these standards is appropriate because particulate matter characteristics such as particle size distribution, loading and particulate matter type are comparable within the above three types of waste burning source categories.

v. Hazardous waste incinerators that meet the 0.015 gr/dscf particulate matter level also generally achieve semivolatile metal system removal efficiencies of over 99% and low volatile metal system removal efficiencies over 99.9%. This indicates superior particulate matter collection efficiency because these metals are controlled by controlling fine and medium-sized particulate matter.

vi. Over 50 percent of all test conditions in the data base, regardless of the type of air pollution control device used, design of the hazardous waste incinerator, or the type of waste burned, currently meet the 0.015 gr/dscf level. This includes hazardous waste incinerators with high particulate matter entrainment rates (such as fluidized bed and rotary kilns) as well as those with wastes that generate difficult to capture fine particulate matter, such as certain liquid injection facilities.

vii. Many incinerators conducted several tests to develop the most flexible operating envelope for day-to-day operations, keeping in view the existing RCRA particulate matter standard of 0.08 gr/dscf. In many test conditions, they elected to meet (and be limited to) the 0.015 gr/dscf level, although they were only required to meet a 0.08 gr/dscf standard.

Many commenters object to the use of engineering information and principles in the selection of the MACT floor level. Some consider engineering information and principles highly subjective and dependent on reviewers' interpretation of the data, while others suggest the use of accepted statistical methods for handling the data. We performed analyses based on available statistical tools for outlier analysis and variability, as discussed previously, but conclude that those approaches are not appropriate. We continue to believe that the use of engineering information and principles is a valid approach to establish the MACT floor (*i.e.,* to determine the level of performance consistently achievable by properly designed and operated floor control technology).

Some commenters object to the use of ''well-designed, operated and maintained'' MACT controls. They consider the term too vague and want specific parameters and features (*e.g.,* air to cloth ratio for fabric filters and power input for electrostatic precipitators) identified. We understand commenters' concerns but such information is simply not readily available. Further, many parameters work in relation with several others making it problematic to quantify optimum values separate from the other values. The system as a whole needs to be optimized for best control efficiency on a case-by-case basis.

Some commenters object to our justification of particulate matter achievability on the basis of vendors' claims. They contend that: (1) Vendors' claims lack quality control and are driven by an incentive for sales; (2) vendors' claims are based on normal operating conditions, not on trial burn type conditions; and (3) MACT floor should not be based on theoretical performance of state-of-the-art technology. We would agree with the comments if the vendor information were from advertising literature, but instead, our analysis was based on warranties. The financial consequences of vendors' warranties require those warranties to be conservative and based on proven performance records, both during normal operations and during trial burn conditions. In any case, we are using vendor information as corroboration, not to establish a level of performance.

In the May 1997 NODA (62 FR at 24222), we requested comments on the alternative MACT evaluation method based on defining medium and low energy venturi-scrubbers burning low ash wastes as an additional MACT control, but screening out facilities from the expanded MACT floor universe that have poor semivolatile metal system removal efficiency. The resulting MACT floor emission level under this approach would be 0.029 gr/dscf. Many commenters agree with the Agency that this technique is unacceptable because it ignores a majority (over 75 percent) of the available particulate matter data in identifying the MACT standard. This result is driven by the fact that corresponding semivolatile metal data are not available from those sources. Other commenters, however, suggest that venturi scrubbers should be designated as MACT particulate matter control. These commenters suggest that sources using venturi scrubbers are within the average of the best performing 12 percent of sources, and there is no technical basis for their exclusion. As stated above, we agree that well-designed and operated venturi scrubbers can achieve the MACT floor level of 0.015gr/dscf under some conditions (as when burning low ash wastes), but their performance is generally not comparable to that of a fabric filter, electrostatic precipitator, or ionizing wet scrubber. Thus, we conclude that sources equipped with venturi scrubbers may not be able to achieve the floor emission level in all cases, and the floor level would have to be inappropriately increased to accommodate unrestricted use of those units.

Some commenters state that we must demonstrate health or environmental benefits if the rule were to require sources to replace existing, less efficient air pollution control devices (*e.g.,* venturi scrubbers incapable of meeting the standard) with a better performing device, particularly because particulate matter is not a hazardous air pollutant under the CAA. These comments are not persuasive and are misplaced as a matter of law. The MACT floor process was established precisely to obviate such issues and to establish a minimum level of control based on performance of superior air pollution control technologies. Indeed, the chief motivation for adopting the technology-based standards to control emissions of hazardous air pollutants in the first instance was the evident failure of the very type of risk-based approach to controlling air toxics as is suggested by the commenters. (See, *e.g.,* H. Rep. No. 490, 101st Cong. 2d Sess., at 318–19.) Inherent in technology-based standard setting, of course, is the possibility that some technologies will have to be replaced if they cannot achieve the same level of performance as the best performing technologies. Finally, with regard to the commenters' points regarding particulate matter not being a hazardous air pollutant, we explain

above why particulate matter is a valid surrogate for certain hazardous air pollutants, and can be used as a means of controlling hazardous air pollutant emissions. In addition, the legislative history appears to contemplate regulation of particulate matter as part of the MACT process. (See S. Rep. No. 228, 101st Cong. 1st Sess., at 170.[98])

We do not consider cost in selecting MACT floor levels. Nevertheless, for purposes of administrative compliance with the Regulatory Flexibility Act and various Executive Orders, we estimate the cost burden on the hazardous waste incinerator universe to achieve compliance. Approximately 38 percent of hazardous waste incinerators currently meet the floor level of 0.015 gr/dscf. The annualized cost for the remaining 115 incinerators to meet the floor level, assuming no market exits, is estimated to be $17.4 million. Nonenumerated metals and particulate matter emissions will be reduced nationally by 5.1 Mg/yr and 1345 Mg/yr, respectively, or over 50 percent from current baseline emissions.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? In the NPRM, we proposed a beyond-the-floor emission level of 69 mg/dscm (0.030 gr/dscf) and solicited comment on an alternative beyond-the-floor emission level of 34 mg/dscm (0.015 gr/dscf) based on improved particulate matter control. (61 FR at 17383.) In the May 1997 NODA, we concluded that a beyond-the-floor standard may not be warranted due to significant cost-effectiveness considerations. (62 FR at 24222.)

In the final rule, we considered more stringent beyond-the-floor controls that would provide additional reductions of particulate matter emissions using fabric filters, electrostatic precipitators, and wet ionizing scrubbers that are designed, operated, and maintained to have improved collection efficiency. We considered a beyond-the-floor level of 16 mg/dscm (0.007 gr/dscf), approximately one-half the floor emission level, for existing incinerators based on improved particulate matter control. We then determined the cost of achieving this reduction in particulate matter, with corresponding reductions in the nonenumerated metals for which particulate matter is a surrogate, to determine if this beyond-the-floor level would be appropriate. The national incremental annualized compliance cost for incinerators to meet this beyond-the-floor level, rather than comply with the floor controls, would be approximately $6.8 million for the entire hazardous waste incinerator industry and would provide an incremental reduction in nonenumerated metals emissions nationally beyond the MACT floor controls of 1.7 Mg/yr. Based on these costs of approximately $4.1 million per additional Mg of nonenumerated metals emissions removed, we conclude that this beyond-the-floor option for incinerators is not acceptably cost-effective nor otherwise justified. Therefore, we do not adopt this beyond-the-floor standard. Poor cost-effectiveness would be particularly unacceptable here considering that these metals also have relatively low toxicity. Thus, the particulate matter standard for new incinerators is 34 mg/dscm. Therefore, the cost-effectiveness threshold we would select would be less than for more toxic pollutants such as dioxin, mercury or other metals.

c. What Is the MACT Floor for New Sources? We proposed a floor level of 0.030 gr/dscf for new sources based on the best performing source in the data base, which used a fabric filter with an air-to-cloth ratio of 3.8 acfm/ft^2. In the May 1997 NODA, we reevaluated the particulate matter floor level and indicated that floor control for existing sources would also appear to be appropriate for new sources. We are finalizing the approach discussed in the May 1997 NODA whereby floor control is a well-designed, operated, and maintained fabric filter, electrostatic precipitator, or ionizing wet scrubber, and the floor emission level is 0.015 gr/dscf.

d. What Are Our Beyond-the-Floor Considerations for New Sources? We considered more stringent beyond-the-floor controls that would provide additional reductions of particulate matter emissions using fabric filters, electrostatic precipitators, and wet ionizing scrubbers that are designed, operated, and maintained to have improved collection efficiency. We considered a beyond-the-floor level of 16 mg/dscm (0.007 gr/dscf), approximately one-half the emissions level for existing sources, for new incinerators based on improved particulate matter control. For analysis purposes, improved particulate matter control assumes the use of higher quality fabric filter bag material. We then determined the cost of achieving this reduction in particulate matter, with corresponding reductions in the nonenumerated metals for which particulate matter is a surrogate, to determine if this beyond-the-floor level would be appropriate. The incremental annualized compliance cost for one new large incinerator to meet this beyond-the-floor level, rather than comply with floor controls, would be approximately $39,000 and would provide an incremental reduction in nonenumerated metals emissions of approximately 0.05 Mg/yr.[99] For a new small incinerator, the incremental annualized compliance cost would be approximately $7,500 and would provide an incremental reduction in nonenumerated metals emissions of approximately 0.008 Mg/yr. Based on these costs of approximately $0.8–1.0 million per additional Mg of nonenumerated metals removed, we conclude that a beyond-the-floor standard of 16 mg/dscm is not warranted due to the high cost of compliance and relatively small nonenumerated metals emission reductions. Poor cost-effectiveness would be particularly unacceptable here considering that these metals also have relatively low toxicity. Thus, the particulate matter standard for new incinerators is 34 mg/dscm.

5. What Are the Standards for Semivolatile Metals?

Semivolatile metals are comprised of lead and cadmium. We establish standards which limit semivolatile metal emissions to 240 µg/dscm for existing sources and 24 µg/dscm for new sources. We discuss below the rationale for adopting these standards.

a. What Is the MACT Floor for Existing Sources? As discussed in Part Four, Section V of the preamble, floor control for semivolatile metals is hazardous waste feedrate control of semivolatile metals plus MACT floor particulate matter control. We use the aggregate feedrate approach to define the level of semivolatile metal feedrate control. We have aggregate feedrate data for 20 test conditions from nine hazardous waste incinerators that are using MACT floor control for particulate matter. The semivolatile metal feedrate levels, expressed as maximum theoretical emission concentrations, for these sources range from 100 µg/dscm to 1.5 g/dscm while the semivolatile emissions range from 1 to 6,000 µg/dscm. The MACT-defining maximum theoretical emission concentration is

[98] Control of particulate matter also helps assure that the standards are sufficiently protective to make RCRA regulation of these sources' air emissions unnecessary (except potentially on a site-specific basis through the omnibus permitting process). See Technical Support Document on Risk Assessment.

[99] Based on the data available, the average emissions in sum of the five nonenumerated metals from incinerators using MACT particulate matter control is approximately 229 µg/dscm. To estimate emission reductions of the nonenumerated metals for specific test conditions, we assume a linear relationship between a reduction in particulate matter and these metals.

5,300 μg/dscm. Upon expanding the MACT pool, only the highest emissions test condition of 6,000 μg/dscm was screened out because the semivolatile metal maximum theoretical emission concentration for this test condition was higher than the MACT-defining maximum theoretical emission concentration. The highest emission test condition in the remaining expanded MACT pool identifies a MACT floor emission level of 240 μg/dscm.

We originally proposed a semivolatile metal floor standard of 270 μg/dscm based on semivolatile metal feedrate control. We subsequently refined the emissions data base and reevaluated the floor methodology, and discussed in the May 1997 NODA a semivolatile metal floor level of 100 μg/dscm. Commenters express serious concerns with the May 1997 NODA approach in two areas. First, they note that the MACT-defining best performing sources have very low emissions, not entirely due to the performance of MACT control, but also due to atypically low semivolatile metal feedrates. Second, they object to our use of a ''breakpoint'' analysis to screen out the outliers from the expanded MACT pool (which was already small due to the screening process to define the feedrate level representative of MACT control). Our final methodology makes adjustments to address these concerns. Under the aggregate feedrate approach, sources with atypically low feedrates of semivolatile metals would not necessarily drive the floor control feedrate level. This is because the aggregate feedrate approach identifies as the best performing sources (relative to feedrate control) those with low feedrates in the aggregate for all metals and chlorine. In addition, the floor methodology no longer uses the breakpoint approach to identify sources not using floor control. These issues are discussed above in detail in Part Four, Section V, of the preamble.

Although cost-effectiveness of floor emission levels is not a factor in defining floor control or emission levels, we have estimated compliance costs and emissions reductions at the floor for administrative purposes. Approximately 66 percent of sources currently meet the semivolatile metal floor level of 240 μg/dscm. The annualized cost for the remaining 64 incinerators to meet the floor level, assuming no market exits, is estimated to be $1.8 million. Semivolatile metal emissions will be reduced nationally by 55.9 Mg per year from the baseline emissions level of 58.5 Mg per year, a reduction of 95.5%.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? We considered more stringent semivolatile metal feedrate control as a beyond-the-floor control to provide additional reductions in emissions. Cost effectiveness considerations would likely come into play, however, and suggest that a beyond-the-floor standard is not warranted. Therefore, we conclude that a beyond-the-floor standard for semivolatile metals for existing sources is not appropriate. We note that a beyond-the-floor standard is not needed to meet our RCRA protectiveness mandate.

c. What Is the MACT Floor for New Sources? Floor control for new sources is: (1) The level of semivolatile metal feedrate control used by the source with the lowest aggregate feedrate for all metals and chlorine;[100] and (2) use of MACT floor particulate matter control for new sources (*i.e.*, a fabric filter, electrostatic precipitator, or wet ionizing scrubber achieving a particulate matter emission level of 0.015 gr/dscf). Three sources in our data base are currently using the floor control selected for all new sources and are achieving semivolatile emissions ranging from 2 μg/dscm to 24 μg/dscm. To ensure that the floor level is achievable by all sources using floor control, we are establishing the floor level for semivolatile metals for new sources at 24 μg/dscm.

d. What Are Our Beyond-the-Floor Considerations for New Sources? We considered more stringent beyond-the-floor controls (*i.e.*, a more restrictive semivolatile metal feedrate) to provide additional reduction in emissions. We determined that cost-effectiveness considerations would likely be unacceptable due to the relatively low concentrations achieved at the floor. This suggests that a beyond-the-floor standard is not warranted. We note that a beyond-the-floor standard is not needed to meet our RCRA protectiveness mandate.

6. What Are the Standards for Low Volatile Metals?

Low volatile metals are comprised of arsenic, beryllium, and total chromium. We establish standards that limit emissions of these metals to 97 μg/dscm for both existing and new incinerators. We discuss below the rationale for adopting these standards.

a. What Is the MACT Floor for Existing Sources? We are using the same approach for low volatile metals as we did for semivolatile metals to define floor control. Floor control for low volatile metals is use of particulate matter floor control and control of the feedrate of low volatile metals to a level identified by the aggregate feedrate approach.

The low volatile metal feedrates for sources using particulate matter floor control range from 300 μg/dscm to 1.4 g/dscm when expressed as maximum theoretical emission concentrations. Emission levels for these sources range from 1 to 803 μg/dscm. Approximately 60 percent of sources using particulate matter floor control have low volatile metal feedrates below the MACT floor feedrate—24,000 μg/dscm, expressed as a maximum theoretical emission concentration.

Upon expanding the MACT pool, the source using floor control with the highest emissions is achieving an emission level of 97 μg/dscm. Accordingly, we are establishing the floor level for low volatile metals for existing sources at 97 μg/dscm to ensure that the floor level is achievable by all sources using floor control.

We identified a low volatile metal floor level of 210 μg/dscm in the April 1996 proposal. The refined data analysis in the May 1997 NODA, based on the revised data base, reduced the low volatile metal floor level to 55 μg/dscm. As with semivolatile metals, commenters express serious concerns with the May 1997 NODA approach, including selection of the breakpoint ''outlier'' screening approach and use of hazardous waste incinerator data with atypically low feedrates for low volatile metals. We acknowledge those concerns and adjusted our methodology accordingly. See discussions above in Part Four, Section V.

We estimated compliance costs to the hazardous waste incinerator universe for administrative purposes. Approximately 63 percent of incinerators currently meet the 97 μg/dscm floor level. The annualized cost for the remaining 69 incinerators to meet the floor level, assuming no market exits, is estimated to be $1.9 million, and would reduce low volatile metal emissions nationally by 6.9 Mg per year from the baseline emissions level of 8 Mg per year.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? We considered more stringent beyond-the-floor controls (*i.e.*, a more restrictive low volatile metal feedrate) to provide additional reduction in emissions. Due to the relatively low concentrations achieved at the floor, we determined that cost-effectiveness considerations would likely be unacceptable. Therefore, we conclude that a beyond-the-floor standard for low volatile metals for existing sources is not

[100] *I.e.*, a semivolatile metal feedrate equivalent to a maximum theoretical emission concentration of 3,500 μg/dscm.

appropriate. We note that a beyond-the-floor standard is not needed to meet our RCRA protectiveness mandate.

c. What Is the MACT Floor for New Sources? We identified a floor level of 260 µg/dscm for new sources at proposal based on the best performing source in the data base. That source uses a venturi scrubber with a low volatile metal feedrate equivalent to a maximum theoretical emission concentration of 1,000 µg/dscm. Our reevaluation of the data base in the May 1997 NODA identified a floor level of 55 µg/dscm based on use of floor control for particulate matter and feedrate control of low volatile metals. Other than the comments on the two issues of low feedrate and the inappropriate use of a breakpoint analysis discussed above, no other significant comments challenged this floor level.

Floor control for new sources is the same as discussed in the May 1997 NODA (*i.e.*, use of particulate matter floor control and feedrate control of low volatile metals), except the floor feedrate level under the aggregate feedrate approach used for today's final rule is 13,000 µg/dscm. Upon expanding the MACT pool, the source using floor control with the highest emissions is achieving an emission level of 97 µg/dscm.[101] Accordingly, we are establishing the floor level for low volatile metals for new sources at 97 µg/dscm to ensure that the floor level is achievable by all sources using floor control.

d. What Are Our Beyond-the-Floor Considerations for New Sources? We considered more stringent beyond-the-floor controls (*i.e.*, a more restrictive low volatile metal feedrate) to provide additional reduction in emissions. Because of the relatively low concentrations achieved, we determined that cost-effectiveness considerations would likely be unacceptable. Therefore, we conclude that a beyond-the-floor standard for low volatile metals for new sources is not appropriate. We note that a beyond-the-floor standard is not needed to meet our RCRA protectiveness mandate.

[101] The emission level for new sources achieving a feedrate control of 13,000 µg/dscm (expressed as a maximum theoretical emission concentration) is the same as the emission level for existing sources achieving a feedrate control of 24,000 µg/dscm because sources feeding low volatile metals in the range of 13,000 to 24,000 µg/dscm have emission levels at or below 97 µg/dscm. Although these sources feel low volatile metals at higher levels than the single best feedrate-controlled source, their emission control devices apparently are more efficient. Thus, they achieved lower emissions than the single best feedrate-controlled source.

7. What Are the Standards for Hydrochloric Acid and Chlorine Gas?

We establish standards for hydrochloric acid and chlorine gas, combined, for existing and new incinerators of 77 and 21 ppmv respectively. We discuss below the rationale for adopting these standards.

a. What Is the MACT Floor for Existing Sources? Almost all hazardous waste incinerators currently use some type of add-on stack gas wet scrubbing system, in combination with control of the feedrate of chlorine, to control emissions of hydrochloric acid and chlorine gas. A few sources use dry or semi-dry scrubbing, alone or in combination with wet scrubbing, while a few rely upon feedrate control only. Wet scrubbing consistently provides a system removal efficiency of over 99 percent for various scrubber types and configurations. Current RCRA regulations require 99% removal efficiency and most sources are achieving greater than 99.9 percent removal efficiency. Accordingly, floor control is defined as wet scrubbing achieving a system removal efficiency of 99 percent or greater combined with feedrate control of chlorine.

The floor feedrate control level for chlorine is 22 µg/dscm, expressed as a maximum theoretical emission concentration, based on the aggregate feedrate approach. The source in the expanded MACT pool (*i.e.*, all sources using floor control) with the highest emission levels of hydrogen chloride and chlorine gas is achieving an emission level of 77 ppmv. Thus, MACT floor for existing sources is 77 ppmv.

At proposal, we also defined floor control as wet scrubbing combined with feedrate control of chlorine. We proposed a floor emission level of 280 ppmv based on a chlorine feedrate control level of 21 µg/dscm, expressed as a maximum theoretical emission concentration. The best performing sources relative to emission levels all use wet scrubbing and feed chlorine at that feedrate or lower. We identified a floor level of 280 ppmv based on all sources in our data base using floor control and after applying a statistically-derived emissions variability factor. In the May 1997 NODA, we again defined floor control as wet (or dry) scrubbing with feedrate control of chlorine. We discussed a floor emission level of 75 ppmv based on the revised data base and break-point floor methodology. Rather than using a break-point analysis in the final rule, we use a floor methodology that identifies floor control as an aggregate chlorine feedrate combined with scrubbing that achieves a removal efficiency of at least 99 percent.

We estimated compliance costs to the hazardous waste incinerator universe for administrative purposes. Approximately 70 percent of incinerators currently meet the hydrochloric acid and chlorine gas floor level of 77 ppmv. The annualized cost for the remaining 57 incinerators to meet that level, assuming no market exits, is estimated to be $4.75 million and would reduce emissions of hydrochloric acid and chlorine gas nationally by 2,670 Mg per year from the baseline emissions level of 3410 Mg per year, a reduction of 78%.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? We considered more stringent beyond-the-floor controls to provide additional reduction in emissions. Due to the relatively low concentrations achieved at the floor, we determined that cost-effectiveness considerations would likely be unacceptable. Therefore, we conclude that a beyond-the-floor standard for hydrochloric acid and chlorine gas for existing sources is not appropriate. We note that a beyond-the-floor standard is not needed to meet our RCRA protectiveness mandate.

c. What Is the MACT Floor for New Sources? We identified a floor level of 280 ppmv at proposal based on the best performing source in the data base. That source uses wet scrubbing and a chlorine feedrate of 17 µg/dscm, expressed as a maximum theoretical emission concentration. Our reevaluation of the revised data base in the May 1997 NODA defined a floor level of 75 ppmv. Based on the aggregate feedrate approach used for today's final rule, we are establishing a floor level of 21 ppmv, based on a chlorine feedrate of 4.7 µg/dscm expressed as a maximum theoretical emission concentration.

d. What Are Our Beyond-the-Floor Considerations for New Sources? We considered more stringent beyond-the-floor controls to provide additional reduction in emissions. Due to the relatively low concentrations achieved at the floor, we determined that cost-effectiveness considerations would likely be unacceptable. Therefore, we conclude that a beyond-the-floor standard for hydrochloric acid and chlorine gas for new sources is not appropriate. We note that a beyond-the-floor standard is not needed to meet our RCRA protectiveness mandate.

8. What Are the Standards for Carbon Monoxide?

We use carbon monoxide as a surrogate for organic hazardous air pollutants. Low carbon monoxide

concentrations in stack gas are an indicator of good control of organic hazardous air pollutants and are achieved by operating under good combustion practices.

We establish carbon monoxide standards of 100 ppmv for both existing and new sources based on the rationale discussed below. Sources have the option to comply with either the carbon monoxide or the hydrocarbon emission standard. Sources that elect to comply with the carbon monoxide standard must also document compliance with the hydrocarbon standard during the performance test to ensure control of organic hazardous air pollutants. See discussion in Part Four, Section IV.B.

a. What Is the MACT Floor for Existing Sources? As proposed, floor control for existing sources is operating under good combustion practices (*e.g.*, providing adequate excess oxygen; providing adequate fuel (waste) and air mixing; maintaining high temperatures and adequate combustion gas residence time at those temperatures).[102] Given that there are many interdependent parameters that affect combustion efficiency and thus carbon monoxide emissions, we were not able to quantify ''good combustion practices.''

We are identifying a floor level of 100 ppmv on an hourly rolling average, as proposed, because it is being achieved by sources using good combustion practices. More than 80 percent of test conditions in our data base have carbon monoxide levels below 100 ppmv, and more than 60 percent have levels below 20 ppmv. Of approximately 20 test conditions with carbon monoxide levels exceeding 100 ppmv, we know the characteristics of many of these sources are not representative of good combustion practices (*e.g.*, use of rotary kilns without afterburners; liquid injection incinerators with rapid combustion gas quenching). In addition, we currently limit carbon monoxide concentrations for hazardous waste burning boilers and industrial furnaces to 100 ppmv to ensure good combustion conditions and control of organic toxic compounds. Finally, we have established carbon monoxide limits in the range of 50 to 150 ppmv on other waste incineration sources (*i.e.*, municipal waste combustors, medical waste incinerators) to ensure good combustion conditions. We are not aware of reasons why it may be more difficult for a hazardous waste incinerator to achieve carbon monoxide levels of 100 ppmv.

We estimated compliance costs to the hazardous waste incinerator universe for administrative purposes. Because carbon monoxide emissions from these sources are already regulated under RCRA, approximately 97 percent of incinerators currently meet the floor level of 100 ppmv. The annualized cost for the remaining six incinerators to meet the floor level, assuming no market exits, is estimated to be $0.9 million and would reduce carbon monoxide emissions nationally by 45 Mg per year from the baseline emissions level of 9170 Mg per year.[103] Although we cannot quantify a corresponding reduction of organic hazardous air pollutant emissions, we estimate these reductions would be significant based on the carbon monoxide reductions.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? We considered more stringent beyond-the-floor controls (*i.e.*, better combustion practices resulting in lower carbon monoxide levels) to provide additional reduction in emissions. Although it is difficult to quantify the reduction in emissions of organic hazardous air pollutants that would be associated with a lower carbon monoxide limit, we concluded that cost-effectiveness considerations would likely come into play, and suggest that a beyond-the-floor standard is not warranted. Therefore, we conclude that a beyond-the-floor standard for carbon monoxide for existing sources is not appropriate. We note that, although control of carbon monoxide (or hydrocarbon) is not an absolute guarantee that nondioxin/furan products of incomplete combustion will not be emitted at levels of concern, this problem (where it may exist) can be addressed through the RCRA omnibus permitting process.

c. What Is the MACT Floor for New Sources? At proposal and in the May 1997 NODA, we stated that operating under good combustion practices defines MACT floor control for new (and existing) sources,[104] and the preponderance of data indicate that a floor level of 100 ppmv over an hourly rolling average is readily achievable. For reasons set forth in the proposal, and absent data to the contrary, we conclude that this floor level is appropriate.

d. What Are Our Beyond-the-Floor Considerations for New Sources? We considered more stringent beyond-the-floor controls (*i.e.*, better combustion practices resulting in lower carbon monoxide levels) to provide additional reduction in emissions. For the reasons discussed above in the context of beyond-the-floor controls for existing sources, however, we conclude that a beyond-the-floor standard for carbon monoxide for new sources is not appropriate.

9. What Are the Standards for Hydrocarbon?

Hydrocarbon concentrations in stack gas are a direct surrogate for emissions of organic hazardous pollutants. We establish hydrocarbon standards of 10 ppmv for both existing and new sources based on the rationale discussed below. Sources have the option to comply with either the carbon monoxide or the hydrocarbon emission standard. Sources that elect to comply with the carbon monoxide standard, however, must nonetheless document compliance with the hydrocarbon standard during the comprehensive performance test.

a. What Is the MACT Floor for Existing Sources? We proposed a hydrocarbon emission standard of 12 ppmv [105] based on good combustion practices, but revised it in the May 1997 NODA to 10 ppmv based on refinements of analysis and the corrected data base.

As proposed, floor control for existing sources is operating under good combustion practices (*e.g.*, providing adequate excess oxygen; providing adequate fuel (waste) and air mixing; maintaining high temperatures and adequate combustion gas residence time at those temperatures). Given that there are many interdependent parameters that affect combustion efficiency and thus hydrocarbon emissions, we are not able to quantify good combustion practices.

We are identifying a floor level for the final rule of 10 ppmv on an hourly rolling average because it is being achieved using good combustion practices. More than 85 percent of test conditions in our data base have hydrocarbon levels below 10 ppmv, and nearly 75 percent have levels below 5 ppmv. Although 13 test conditions in our data base representing 7 sources have hydrocarbon levels higher than 10 ppmv, we conclude that these sources

[102] USEPA, ''Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

[103] As discussed previously in the text, you have the option of complying with the hydrocarbon emission standard rather than the carbon monoxide standard. This is because carbon monoxide is a conservative indicator of the potential for emissions of organic compounds while hydrocarbon concentrations in stack gas are a direct measure of emissions of organic compounds.

[104] Because we cannot quantify good combustion practices, floor control for the single best controlled source is the same as for existing sources (*i.e.*, that combination of design, operation, and maintenance that achieves good combustion as evidenced by carbon monoxide levels of 100 ppmv or less on an hourly rolling average).

[105] Based on an hourly rolling average, reported as propane, corrected to 7 percent oxygen, dry basis.

are not operating under good combustion practices. For example, one source is a rotary kiln without an afterburner. Another source is a fluidized bed type incinerator that operates at lower than typical combustion temperatures without an afterburner while another source is operating at high carbon monoxide levels, indicative of poor combustion efficiency.[106]

Some commenters on the May 1997 NODA object to the 10 ppmv level and suggest adopting a level of 20 ppmv based on the BIF rule (§ 266.104(c)), and an earlier hazardous waste incinerator proposal (55 FR 17862 (April 27, 1990)). These commenters cite sufficient protectiveness at the 20 ppmv level. We conclude that this comment is not on point because the MACT standards are technology rather than risk-based. The MACT standards must reflect the level of control that is not less stringent than the level of control achieved by the best performing sources. Because hazardous waste incinerators are readily achieving a hydrocarbon level of 10 ppmv using good combustion practices, that floor level is appropriate.

Some commenters also object to the requirement to use heated flame ionization hydrocarbon detectors[107] in hazardous waste incinerators that use wet scrubbers. The commenters state that these sources have a very high moisture content in the flue gas that hinders proper functioning of the specified hydrocarbon detectors. We agree that hydrocarbon monitors may be hindered in these situations. For this and other reasons (*e.g.*, some sources can have high carbon monoxide but low hydrocarbon levels), the final rule gives sources the option of: (1) Continuous hydrocarbon monitoring; or (2) continuous carbon monoxide monitoring and demonstration of compliance with the hydrocarbon standard only during the performance test.

We estimated compliance costs to the hazardous waste incinerator universe for administrative purposes. Approximately 97 percent of incinerators currently meet the hydrocarbon floor level of 10 ppmv. The annualized cost for the remaining six incinerators to meet the floor level, assuming no market exits, is estimated to be $0.35 million, and would reduce hydrocarbon emissions nationally by 28 Mg per year from the baseline emissions level of 292 Mg per year. Although the corresponding reduction of organic hazardous air pollutant emissions cannot be quantified, these reductions are qualitatively assessed as significant.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? We considered more stringent beyond-the-floor controls (*i.e.*, better combustion practices resulting in lower hydrocarbon levels) to provide additional reduction in emissions. Although it is difficult to quantify the reduction in emissions of organic hazardous air pollutants that would be associated with a lower hydrocarbon limit, cost-effectiveness considerations would likely come into play, however, and suggest that a beyond-the-floor standard is not warranted. Therefore, we conclude that a beyond-the-floor standard for hydrocarbon emissions for existing sources is not appropriate. We note further that, although control of hydrocarbon emissions is not an absolute guarantee that nondioxin products of incomplete combustion will not be emitted at levels of concern, this problem (where it may exist) can be addressed through the RCRA omnibus permitting process.

c. What Is the MACT Floor for New Sources? At proposal and in the May 1997 NODA, we stated that operation under good combustion practices at new (and existing) hazardous waste incinerators defines the MACT control.[108] As discussed above, sources using good combustion practices are achieving hydrocarbon levels of 10 ppmv or below. Comments on this subject were minor and did not identify any problems in achieving the 10 ppmv level by new sources. Thus, we conclude that a floor level of 10 ppmv on hourly rolling average is appropriate for new sources.

d. What Are Beyond-the-Floor Considerations for New Sources? We considered more stringent beyond-the-floor controls (*i.e.*, better combustion practices) to provide additional reduction in emissions. For the reasons discussed above in the context of beyond-the-floor controls for existing sources, however, we conclude that a beyond-the-floor standard for hydrocarbons for new sources is not appropriate.

10. What Are the Standards for Destruction and Removal Efficiency?

We establish a destruction and removal efficiency (DRE) standard for existing and new incinerators to control emissions of organic hazardous air pollutants other than dioxins and furans. Dioxins and furans are controlled by separate emission standards. See discussion in Part Four, Section IV.A. The DRE standard is necessary, as previously discussed, to complement the carbon monoxide and hydrocarbon emission standards, which also control these hazardous air pollutants.

The standard requires 99.99 percent DRE for each principal organic hazardous constituent (POHC), except that 99.9999 percent DRE is required if specified dioxin-listed hazardous wastes are burned. These wastes are listed as—F020, F021, F022, F023, F026, and F027—RCRA hazardous wastes under Part 261 because they contain high concentrations of dioxins.

a. What Is the MACT Floor for Existing Sources? Existing sources are currently subject to DRE standards under § 264.342 and § 264.343(a) that require 99.99 percent DRE for each POHC, except that 99.9999 percent DRE is required if specified dioxin-listed hazardous wastes are burned. Accordingly, these standards represent MACT floor. Since all hazardous waste incinerators are currently subject to these DRE standards, they represent floor control, *i.e.*, greater than 12 percent of existing sources are achieving these controls.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? Beyond-the-floor control would be a requirement to achieve a higher percentage DRE, for example, 99.9999 percent DRE for POHCs for all hazardous wastes. A higher DRE could be achieved by improving the design, operation, or maintenance of the combustion system to achieve greater combustion efficiency.

Sources will not incur costs to achieve the 99.99 percent DRE floor because it is an existing RCRA standard. A substantial number of existing incinerators are not likely to be routinely achieving 99.999 percent DRE, however, and most are not likely to be achieving 99.9999 percent DRE. Improvements in combustion efficiency will be required to meet these beyond-the-floor DREs. Improved combustion efficiency is accomplished through better mixing, higher temperatures, and longer residence times. As a practical matter, most combustors are mixing-limited. Thus, improved mixing is

[106] USEPA, ''Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

[107] See Performance Specification 8A, appendix B, part 60, ''Specifications and test procedures for carbon monoxide and oxygen continuous monitoring systems in stationary sources.''

[108] Because we cannot quantify good combustion practices, floor control for the single best controlled soruce is the same as for existing sources (*i.e.*, that combination of design, operation, and maintenance that achieves good combustion as evidenced by hydrocarbon levels of 10 ppmv or less on an hourly rolling average).

necessary for improved DREs. For a less-than-optimum burner, a certain amount of improvement may typically be accomplished by minor, relatively inexpensive combustor modifications—burner tuning operations such as a change in burner angle or an adjustment of swirl—to enhance mixing on the macro-scale. To achieve higher and higher DREs, however, improved mixing on the micro-scale may be necessary requiring significant, energy intensive and expensive modifications such as burner redesign and higher combustion air pressures. In addition, measurement of such DREs may require increased spiking of POHCs and more sensitive stack sampling and analysis methods at added expense.

Although we have not quantified the cost-effectiveness of a beyond-the-floor DRE standard, we do not believe that it would be cost-effective. For reasons discussed above, we believe that the cost of achieving each successive order-of-magnitude improvement in DRE will be at least constant, and more likely increasing. Emissions reductions diminish substantially, however, with each order of magnitude improvement in DRE. For example, if a source were to emit 100 gm/hr of organic hazardous air pollutants assuming zero DRE, it would emit 10 gm/hr at 90 percent DRE, 1 gm/hr at 99 percent DRE, 0.1 gm/hr at 99.9 percent DRE, 0.01 gm/hr at 99.99 percent DRE, and 0.001 gm/hr at 99.999 percent DRE. If the cost to achieve each order of magnitude improvement in DRE is roughly constant, the cost-effectiveness of DRE decreases with each order of magnitude improvement in DRE. Consequently, we conclude that this relationship between compliance cost and diminished emissions reductions associated with a more stringent DRE standard suggests that a beyond-the-floor standard is not warranted.

c. What Is the MACT Floor for New Sources? The single best controlled source, and all other hazardous waste incinerators, are subject to the existing RCRA DRE standard under § 264.342 and § 264.343(a). Accordingly, we adopt this standard as the MACT floor for new sources.

d. What Are Our Beyond-the-Floor Considerations for New Sources? As discussed above, although we have not quantified the cost-effectiveness of a more stringent DRE standard, diminishing emissions reductions with each order of magnitude improvement in DRE suggests that cost-effectiveness considerations would likely come into play. We conclude that a beyond-the-floor standard is not warranted.

VII. What Are the Standards for Hazardous Waste Burning Cement Kilns?

A. To Which Cement Kilns Do Today's Standards Apply?

The standards promulgated today apply to each existing, reconstructed, and newly constructed Portland cement manufacturing kiln that burns hazardous waste. These standards apply to all hazardous waste burning cement kilns (both major source and area source cement plants). Portland cement kilns that do not engage in hazardous waste burning operations are not subject to this NESHAP. However, these hazardous waste burning kilns would be subject to the NESHAP for other sources of hazardous air pollutants at the facility (*e.g.*, clinker cooler stack) that we finalized in June 1999.[109]

B. How Did EPA Initially Classify Cement Kilns?

1. What Is the Basis for a Separate Class Based on Hazardous Waste Burning?

Portland cement manufacturing is one of the initial 174 categories of major and area sources of hazardous air pollutants listed pursuant to section 112(c)(1) for which section 112(d) standards are to be established.[110] We divided the Portland cement manufacturing source category into two different classes based on whether the cement kiln combusts hazardous waste. This action was taken for two principal reasons: If hazardous wastes are burned in the kiln, emissions of hazardous air pollutants can be different for the two types of kilns in terms of both types and concentrations of hazardous air pollutants emitted, and metals and chlorine emissions are controlled in a significantly different manner.

A comparison of metals levels in coal and in hazardous waste fuel burned in lieu of coal on a heat input basis reveals that hazardous waste frequently contains higher concentrations of hazardous air pollutant metals (*i.e.*, mercury, semivolatile metals, low volatile metals) than coal. Hazardous waste contains higher levels of semivolatile metals than coal by more than an order of magnitude at every cement kiln in our data base.[111] In addition, coal concentrations of mercury and low volatile metals were less than hazardous waste by approximately an order of magnitude at every facility except one. Thus, a cement kiln feeding a hazardous waste fuel is likely to emit more metal hazardous air pollutants than a nonhazardous waste burning cement kiln. Given this difference in emissions characteristics, we divided the Portland cement manufacturing source category into two classes based on whether hazardous waste is burned in the cement kiln.

Today's rule does not establish hazardous air pollutant emissions limits for other hazardous air pollutant-emitting sources at a hazardous waste burning cement plant. These other sources of hazardous air pollutants may include materials handling operations, conveyor system transfer points, raw material dryers, and clinker coolers. Emissions from these sources are subject to the requirements promulgated in the June 14, 1999 Portland cement manufacturing NESHAP. See 64 FR 31898. These standards are applicable to these other sources of hazardous air pollutants at all Portland cement plants, both for nonhazardous waste burners and hazardous waste burners.

In addition, this regulation does not establish standards for cement kiln dust management facilities (*e.g.*, cement kiln dust piles or landfills). We are developing cement kiln dust storage and disposal requirements in a separate rulemaking.

2. What Is the Basis for Differences in Standards for Hazardous Waste and Nonhazardous Waste Burning Cement Kilns?

Today's final standards for hazardous waste burning cement kilns are identical in some respects to those finalized for nonhazardous waste burning cement kilns on June 14, 1999. The standards differ, however, in several important aspects. A comparison of the major features of the two sets of standards and the basis for major differences is discussed below.

a. How Does the Regulation of Area Sources Differ? As discussed earlier, this rule makes a positive area source finding under section 112(c)(3) of the CAA (*i.e.*, a finding that hazardous air pollutant emissions from an area source can pose potential risk to human health and the environment) for existing hazardous waste burning cement kilns and subjects area sources to the same standards that apply to major sources. (See Part Three, Section III.B of today's preamble.) For nonhazardous waste burning cement kilns, however, we regulate area sources under authority of

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[109] On June 14, 1999, we promulgated regulations for kiln stack emissions for nonhazardous waste burning cement kilns and other sources of hazardous air pollutants at all Portland manufacturing plants. (See 64 FR 31898.)

[110] EPA published an initial list of 174 categories of area and major sources in the **Federal Register** on July 16, 1992. (See 57 FR at 31576.)

[111] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

section 112(c)(6) of the CAA, and so apply MACT standards only to the section 112(c)(6) hazardous air pollutants emitted from such sources.

The positive finding for hazardous waste burning cement kilns is based on several factors and, in particular, on concern about potential health risk from emissions of mercury and nondioxin/furan organic hazardous air pollutants which are products of incomplete combustion.

However, we do not have this same level of concern with hazardous air pollutant emissions from nonhazardous waste burning cement kilns located at area source cement plants, and so did not make a positive area source finding. As discussed above, mercury emissions from hazardous waste burning cement kilns are generally higher than those from nonhazardous waste burning cement kilns. Also, nondioxin and nonfuran organic hazardous air pollutants emitted from hazardous waste burning cement kilns have the potential to be greater than those from nonhazardous waste burning cement kilns because hazardous waste can contain high concentrations of a wide-variety of organic hazardous air pollutants. In addition, some hazardous waste burning cement kilns feed containers of hazardous waste at locations (*e.g.*, midkiln, raw material end of the kiln) other than the normal coal combustion zone. If such firing systems are poorly designed, operated, or maintained, emissions of nondioxin and furan organic hazardous air pollutants could be substantial (and, again, significantly greater than comparable emissions from nonhazardous waste Portland cement plants). Finally, hazardous air pollutant emissions from nonhazardous waste burning cement kilns currently are not regulated uniformly under another statute as is the case for hazardous waste burning cement kilns which affects which pollutants are controlled at the floor for each class.

Under the June 1999 final rule, existing and new nonhazardous waste burning cement kilns at area source plants are subject to dioxin and furan emission standards, and a hydrocarbon [112] standard for new nonhazardous waste burning cement kilns that are area sources. These standards are promulgated under the authority of section 112(c)(6). That section requires the Agency to establish MACT standards for source categories contributing significantly in the aggregate to emissions of identified, particularly hazardous air pollutants. The MACT process was also applied to the control of mercury, although the result was a standard of no control.

b. How Do the Emission Standards Differ? The dioxin, furan and particulate matter emission standards for nonhazardous waste burning cement kilns are identical to today's final standard for hazardous waste burning cement kilns. The standards for both classes of kilns are floor standards and are identical because hazardous waste burning is not likely to affect emissions of either dioxin/furan [113] or particulate matter. We also conclude that beyond-the-floor standards for these pollutants would not be cost-effective for either class of cement kilns.

Under today's rule, hazardous waste burning cement kilns are subject to emission standards for mercury, semivolatile metals, low volatile metals, and hydrochloric acid/chlorine gas, but we did not finalize such standards for nonhazardous waste burning cement kilns. Currently, emissions of these hazardous air pollutants from hazardous waste burning cement kilns are regulated under RCRA. Therefore, we could establish floor levels for each pollutant under the CAA. These hazardous air pollutants, however, currently are not controlled for nonhazardous waste burning cement kilns and floor levels would be uncontrolled levels (*i.e.*, the highest emissions currently achieved).[114] We considered beyond-the-floor controls and emission standards for mercury and hydrochloric acid for nonhazardous waste burning cement kilns, but conclude that beyond-the-floor standards are not cost-effective, especially considering the lower rates of current emissions for nonhazardous waste burning plants.

Finally, under today's rule, hazardous waste burning cement kilns are subject to emission limits on carbon monoxide and hydrocarbon and a destruction and removal efficiency standard to control nondioxin/furan organic hazardous air pollutants. We identified these controls as floor controls because carbon monoxide and hydrocarbon emissions are controlled for these sources under RCRA regulations, as is destruction and removal efficiency.[115] For nonhazardous waste burning cement kilns, carbon monoxide and hydrocarbon emissions currently are not controlled, and the destruction and removal efficiency standard, established under RCRA, does not apply. Therefore, carbon monoxide, hydrocarbon control and the destruction and removal efficiency standard are not floor controls for this second group of cement kilns. We considered beyond-the-floor controls for hydrocarbon from nonhazardous waste burning cement kilns and determined that beyond-the-floor controls for existing sources are not cost-effective. The basis of this conclusion is discussed in the proposed rule for nonhazardous waste burning cement kilns (see 63 FR at 14202). We proposed and finalized, however, a hydrocarbon emission standard for new source nonhazardous waste cement kilns based on feeding raw materials without an excessive organic content.[116] See 63 FR at 14202 and 64 FR 31898.

We did not consider a destruction and removal efficiency standard as a beyond-the-floor control for nonhazardous waste burning cement kilns because, based historically on a unique RCRA statutory provision, the DRE standard is designed to ensure destruction of organic hazardous air pollutants in hazardous waste fed to hazardous waste combustors. The underlying rationale for such a standard is absent for nonhazardous waste burning cement kilns that do not combust hazardous waste and that feed materials (*e.g.*, limestone, coal) that contain only incidental levels of organic hazardous air pollutants.

c. How Do the Compliance Procedures Differ? We finalized compliance procedures for nonhazardous waste burning cement kilns that are similar to those finalized today for hazardous waste burning cement kilns. For particulate matter, we are implementing a coordinated program to document the feasibility of particulate matter continuous emissions monitoring

[112] Hydrocarbon emissions would be limited as a surrogate for polycyclic organic matter, a category of organic hazardous air pollutants identified in section 112(c)(6).

[113] Later in the text, however, we discuss how hazardous waste burning may potentially affect dioxin and furan emissions and the additional requirements for hazardous waste burning cement kilns that address this concern.

[114] Although semivolatile metal and low volatile metal are controlled by nonhazardous waste burning cement kilns, along with other metallic hazardous air pollutants, by controlling particulate matter. These metals are not individually controlled by nonhazardous waste burning cement kilns as they are for hazardous waste burning cement kilns by virtue of individual metal feedrate limits established under existing RCRA regulations.

[115] For hazardous waste burning cement kilns, existing RCRA carbon monoxide and hydrocarbon standards do not apply to the main stack of a kiln equipped with a by-pass or other means of measuring carbon monoxide or hydrocarbon at mid kiln to ensure good combustion of hazardous waste. Therefore, there is no carbon monoxide or hydrocarbon floor control for such stacks, and we conclude that beyond-the-floor controls would not be cost-effective.

[116] Consistent with the nonhazardous waste burnign cement kiln proposal, however, we subject the main stack of such new source hazardous waste burning cemen tkilns to a hydrocarbon standard.

systems on both nonhazardous waste and hazardous waste burning cement kilns. We plan to establish a continuous emissions monitoring systems-based emission level through future rulemaking that is achievable by sources equipped with MACT control (*i.e.*, an electrostatic precipitator or fabric filter designed, operated, and maintained to meet the New Source Performance Standard particulate matter standard). In the interim, we use the opacity standard as required by the New Source Performance Standard for Portland cement plants under § 60.62 to ensure compliance with the particulate matter standard for both hazardous waste and nonhazardous waste burning cement kilns.

For dioxin/furan, the key compliance parameter will be identical for both hazardous waste and nonhazardous waste burning cement kilns—control of temperature at the inlet to the particulate matter control device. Other factors that could contribute to the formation of dioxins and furans, however, are not completely understood. As a result, hazardous waste burning cement kilns have additional compliance requirements to ensure that hazardous waste is burned under good combustion conditions. These additional controls are necessary because of the dioxin and furan precursors that can be formed from improper combustion of hazardous waste, given the hazardous waste firing systems used by some hazardous waste burning cement kilns and the potential for hazardous waste to contain high concentrations of many organic hazardous air pollutants not found in conventional fuels or cement kiln raw materials.

We also require both hazardous waste and nonhazardous waste burning cement kilns to conduct performance testing midway between the five-year periodic comprehensive performance testing to confirm that dioxin/furan emissions do not exceed the standard when the source operates under normal conditions.

C. What Further Subcategorization Considerations Are Made?

We also fully considered further subdividing the class of hazardous waste burning cement kilns itself. For the reasons discussed below, we decided that subcategorization is not needed to determine achievable MACT standards for all hazardous waste burning cement kilns.

We considered, but rejected, subdividing the hazardous waste burning cement kiln source category on the basis of raw material feed preparation, more specifically wet process versus dry process. In the wet process, raw materials are ground, wetted, and fed into the kiln as a slurry. Approximately 70 percent of the hazardous waste burning cement kilns in operation use a wet process. In the dry process, raw materials are ground dry and fed into the kiln dry. Within the dry process there are three variations: Long kiln dry process, preheater process, and preheater-precalciner process. We decided not to subcategorize the hazardous waste burning cement kiln category based on raw material feed preparation because: (1) The wet process kilns and all variations of the dry process kilns use similar raw materials, fossil fuels, and hazardous waste fuels; (2) the types and concentrations of uncontrolled hazardous air pollutant emissions are similar for both process types;[117] (3) the same types of particulate matter pollution control equipment, specifically either fabric filters or electrostatic precipitators, are used by both process types, and the devices achieve the same level of performance when used by both process types; and (4) the MACT controls we identify are applicable to both process types of cement kilns. For example, MACT floor controls for metals and chlorine include good particulate matter control and hazardous waste feedrate control, as discussed below, the particulate matter standard promulgated today is based on the New Source Performance Standard, which applies to all cement kilns irrespective of process type. Further, a cement kiln operator has great discretion in the types of hazardous waste they accept including the content of metals and chlorine in the waste. These basic control techniques—particulate matter control and feedrate control of metals and chlorine—clearly show that subcategorization based on process type is not appropriate.

Some commenters stated that it is not feasible for wet process cement kilns to use fabric filters, especially in cold climates, and thus subcategorization based on process type is appropriate. The problem, commenters contend, is that the high moisture content of the flue gas will clog the fabric if the cement-like particulate is wetted and subsequently dried, resulting in reduced performance and early replacement of the fabric filter bags. Other commenters disagreed with these assertions and stated that fabric filter technology can be readily applied to wet process kilns given the exit temperatures of the combustion gases and the ease of insulating fabric filter systems to minimize cold spots in the baghouse to avoid dew point problems and minimize corrosion. These commenters pointed to numerous wet process applications currently in use at cement kilns with fabric filter systems located in cold climates to support their claims.[118] In light of the number of wet process kilns already using fabric filters and their various locations, we conclude that wet process cement kilns can be equipped with fabric filter systems and that subdividing by process type on this basis is not necessary or warranted. A review of the particulate matter emissions data for one wet hazardous waste burning cement kiln using a fabric filter shows that it is achieving the particulate matter standard. We do not have data in our data base from the only other wet hazardous waste burning cement kiln using a fabric filter; however, this cement kiln recently installed and upgraded to a new fabric filter system.

We also fully considered, but ultimately rejected, subdividing the hazardous waste burning cement kiln source category between long kilns and short kilns (preheater and preheater-precalciner) technologies, and those with in-line kiln raw mills. This subcategorization approach was recommended by many individual cement manufacturing member companies and a cement manufacturing trade organization. Based on information on the types of cement kilns that are currently burning hazardous waste, these three subcategories consist of the following four subdivisions: (1) Short kilns with separate by-pass and main stacks; (2) short kilns with a single stack that handles both by-pass and preheater or precalciner emissions; (3) long dry kilns that use kiln gas to dry raw meal in the raw mill; and (4) others wet kilns, and long dry kilns not using in-line kiln raw mill drying. Currently, each of the first three categories consists of only one cement kiln facility while

[117] Although dry process kilns with a separate by-pass stack can have higher metals emissions from that stack compared to the main stack of other kilns, today's rule allows such kilns to flowrate-average its emissions between the main and by-pass stack. The average emissions are similar to the emissions from dry and wet kilns that have only one stack. Similarly, kilns with in-line raw mills have higher mercury emissions when the raw mill is off. Today's rule allows such kilns to time-weight average their emissions, however, and the time-weighted emissions for those kilns are similar to emissions from other hazardous waste burning cement kilns.

[118] We are aware of four wet process cement kiln facilities operating with fabric filters: Dragon (Thomaston, ME), Giant (Harleyville, SC), Holnam (Dundee, MI), and LaFarge (Paulding, OH). Commenters also identified kilns in Canada operating with fabric filters.

the kilns at the remaining 15 facilities are in the fourth category: wet kilns or long dry kilns that do not use in-line kiln raw mill drying.

Commenters state that these subcategories should be considered because the unique design or operating features of the different types of kilns could have a significant impact on emissions of one or more hazardous air pollutants that we proposed to regulate. Specifically, commenters noted the potential flue gas characteristic differences for cement kilns using alkali bypasses on short kilns and in-line kiln raw mills. For example, kilns with alkali bypasses are designed to divert a portion of the flue gas, approximately 10–30%, to remove the problematic alkalis, such as potassium and sodium oxides, that can react with other compounds in the cool end of the kiln resulting in operation problems. Thus, bypasses allow evacuation of the undesirable alkali metals and salts, including semivolatile metals and chlorides, entrained in the kiln exit gases before they reach the preheater cyclones. As a result, the commenters stated that the emission concentration of semivolatile metals in the bypass stack is greater than in the main stack, and therefore the difference in emissions supports subcategorization.

We agree, in theory, that the emissions profile for some hazardous air pollutants can be different for the three kilns types—short kilns with and without separate bypass stacks, long kilns with in-line kiln raw mills. To consider this issue further, we analyzed floor control and floor emissions levels based only on the data and information from the other long wet kilns and long dry kilns not using raw mill drying. We then considered whether the remaining three kiln types could apply the same MACT controls and achieve the resulting emission standards. We conclude that these three types of kilns at issue can use the MACT controls and achieve the corresponding emission levels identified in today's rule for the wet kilns and long dry kilns not using raw mill drying.[119] As a result, we conclude that there is no practical necessity driving a subcategorization approach even though one would be theoretically possible. Further, to ensure that today's standards are achievable by all cement kilns, we establish a provision that allows cement kilns operating in-line kiln raw mills to average their emissions based on a time-weighted average concentration that considers the length of time the in-line raw mill is on-line and off line. We also adopt a provision that allows short cement kilns with dual stacks to average emissions on a flow-weighted basis to demonstrate compliance with the emissions standards. (See Part Five, Section X—Special Provisions for a discussion of these provisions.)

In the case of hydrocarbons and carbon monoxide, we developed final standards that reflect the concerns raised by several commenters. We determined that this approach best accommodated the unique design and operating differences between long wet and long dry process and short kilns using either a preheater or a preheater and precalciner.

Existing hazardous waste preheater and preheater-precalciner cement kilns, one of each type is burning hazardous waste, are equipped with bypass ducts that divert a portion of the kiln off-gas through a separate particulate matter control device to remove problematic alkali metals. Long cement kilns do not use bypasses designed to remove alkali metals. The significance of this operational difference is that hydrocarbon and carbon monoxide levels in the bypass gas of short kilns is more representative of the combustion efficiency of burning hazardous waste and other fuels in the kiln than the measurements made in the main stack. Main stack gas measurements of hydrocarbons and carbon monoxide, regardless of process type, also include contributions from trace levels of organic matter volatilized from the raw materials, which can mask the level of combustion efficiency achieved in the kiln.

Today's tailored standards require cement kilns to monitor hydrocarbons and carbon monoxide at the location best indicative of good combustion. For short kilns with bypasses, the final rule requires monitoring of hydrocarbons and carbon monoxide in the bypass. Long kilns are required to comply with the hydrocarbon and carbon monoxide standards in the main stack. However, long kilns that operate a mid-kiln sampling system, for the purpose of removing a representative portion of the kiln off-gas to measure combustion efficiency, can comply with the hydrocarbon and carbon monoxide standards at the midkiln sampling point.

In addition, establishing separate hydrocarbon and carbon monoxide standards reflects the long and short kiln subcategorization approach recommended by some commenters. The standards differ because MACT floor control for hydrocarbons and carbon monoxide is based primarily on the existing requirements of the Boiler and Industrial Furnace rule. In that rule, the unique design and operating features of long and short kilns were considered in establishing type specific emission limits for hydrocarbons and carbon monoxide. Thus, MACT floor control for long and short kilns is different. However, we note these same unique design and operating features were not a factor in establishing standards for other pollutants, including mercury, semivolatile and low volatile metals, and hydrochloric acid/chlorine gas, in the Boiler and Industrial Furnace rule.

For the reasons discussed above, subcategorization would not appear to be needed to establish uniform, achievable MACT standards for all cement kilns burning hazardous waste. Thus, because the differences among kiln types ''does not affect the feasibility and effectiveness of air pollution control technology,'' subcategorization is not appropriate. S. Rep. No. 228, 101st Cong. 1st sess. 166.

D. What Are The Standards for Existing and New Cement Kilns?

1. What Are the Standards for Cement Kilns?

In this section, the basis for the emissions standards for cement kilns is discussed. The kiln emission limits apply to the kiln stack gases, in-line kiln raw mill stack gases if combustion gases pass through the in-line raw mill, and kiln alkali bypass stack gases if discharged through a separate stack from cement plants that burn hazardous waste in the kiln. The emissions standards are summarized below:

[119] USEPA, ''Final Technical Support Document for HWC MACT Standards, Volume III: Selection of MACT Standards and Technologies,'' July 1999.

STANDARDS FOR EXISTING AND NEW CEMENT KILNS

Hazardous air pollutant or hazardous air pollutant surrogate	Emissions standard [1]	
	Existing sources	New sources
Dioxin and furan	0.20 ng TEQ/dscm; or 0.40 ng TEQ/dscm and control of flue gas temperature not to exceed 400°F at the inlet to the particulate matter control device.	0.20 ng TEQ/dscm; or 0.40 ng TEQ/dscm and control of flue gas temperature not to exceed 400°F at the inlet to the particulate matter control device.
Mercury	120 μg/dscm	56 μg/dscm.
Particulate matter [2]	0.15 kg/Mg dry feed and 20% opacity	0.15 kg/Mg dry feed and 20% opacity.
Semivolatile metals	240 μg/dscm	180 μg/dscm.
Low volatile metals	56 μg/dscm	54 μg/dscm.
Hydrochloric acid and chlorine gas	130 ppmv	86 ppmv.
Hydrocarbons: kilns without by-pass [3, 6]	20 ppmv (or 100 ppmv carbon monoxide) [3]	Greenfield kilns: 20 ppmv (or 100 ppmv carbon monoxide and 50 ppmv [5] hydrocarbons).
		All others: 20 ppmv (or 100 ppmv carbon monoxide) [3].
Hydrocarbons: kilns with by-pass; main stack [4, 6].	No main stack standard	50 ppmv [5].
Hydrocarbons: kilns with by-pass; by-pass duct and stack [3, 4, 6].	10 ppmv (or 100 ppmv carbon monoxide)	10 ppmv (or 100 ppmv carbon monoxide).
Destruction and removal efficiency	For existing and new sources, 99.99% for each principal organic hazardous constituent (POHC) designated. For sources burning hazardous wastes F020, F021, F022, F023, F026, or F027, 99.9999% for each POHC designated.	

[1] All emission levels are corrected to 7% O_2, dry basis.
[2] If there is an alkali by-pass stack associated with the kiln or in-line kiln raw mill, the combined particulate matter emissions from the kiln or in-line kiln raw mill and the alkali by-pass must be less than the particulate matter emissions standard.
[3] Cement kilns that elect to comply with the carbon monoxide standard must demonstrate compliance with the hydrocarbon standard during the comprehensive performance test.
[4] Measurement made in the by-pass sampling system of any kiln (e.g., alkali by-pass of a preheater and/or precalciner kiln; midkiln sampling system of a long kiln).
[5] Applicable only to newly-constructed cement kilns at greenfield sites (see discussion in Part Four, Section VII.D.9). 50 ppmv standard is a 30-day block average limit. Hydrocarbons reported as propane.
[6] Hourly rolling average. Hydrocarbons are reported as propane.

2. What Are the Dioxin and Furan Standards?

In today's rule, we establish a standard for new and existing cement kilns that limits dioxin/furan emissions to either 0.20 ng TEQ/dscm; or 0.40 ng TEQ/dscm and temperature at the inlet to the particulate matter control device not to exceed 400°F.[120] Our rationale for these standards is discussed below.

a. What Is the MACT Floor for Existing Sources? In the April 1996 proposal, we identified floor control as either temperature control at the inlet to the particulate matter control device of less than 418°F, or achieving a specific level of dioxin/furan emissions based upon levels achievable using proper temperature control. (61 FR at 17391.) The proposed floor emission level was 0.20 ng TEQ/dscm, or temperature at the inlet to the electrostatic precipitator or fabric filter not to exceed 418°F. In the May 1997 NODA, we identified an alternative data analysis method to identify floor control and the floor emission level. Floor control for dioxin/furan was defined as temperature control at the inlet to the electrostatic precipitator or fabric filter at 400°F, which was based on further engineering evaluation of the emissions data and other available information. That analysis resulted in a floor emission level of 0.20 ng TEQ/dscm, or 0.40 ng TEQ/dscm and temperature at the inlet to the electrostatic precipitator or fabric filter not to exceed 400°F. (62 FR at 24226.) The 0.40 ng TEQ/dscm standard is the level that all cement kilns, including data from nonhazardous waste burning cement kilns, are achieving when operating at the MACT floor control level or better. We considered a data set that included dioxin/furan emissions from nonhazardous waste burning cement kilns because these data are adequately representative of general dioxin/furan behavior and control in either type of kiln. The impacts of hazardous waste constituents (HAPs) on the emissions of those HAPs prevent us from expanding our database for other HAPs in a similar way.

We conclude that the floor methodology discussed in the May 1997 NODA is appropriate and we adopt this approach in today's final rule. We identified two technologies for control of dioxin/furan emissions from cement kilns in the May 1997 NODA. The first technology achieves low dioxin/furan emissions by quenching kiln gas temperatures at the exit of the kiln so that gas temperatures at the inlet to the particulate matter control device are below the temperature range of optimum dioxin/furan formation. For example, we are aware of several cement kilns that have recently added flue gas quenching units upstream of the particulate matter control device to reduce the inlet particulate matter control device temperature resulting in significantly reduced dioxin/furan levels.[121] The other technology is activated carbon injected into the kiln exhaust gas. Since activated carbon injection is not currently used by any hazardous waste burning cement kilns, this technology was evaluated only as part of a beyond-the-floor analysis.

As discussed in the May 1997 NODA, specifying a temperature limitation of 400°F or lower is appropriate for floor control because, from an engineering perspective, it is within the range of

[120] The temperature limit applies at the inlet to a dry particulate matter control device that suspends particulate matter in the combustion gas stream (*e.g.*, electrostatic precipitator, fabric filter) such that surface-catalyzed formation of dioxin/furan is enhanced. The temperature limit does not apply to a cyclone control device, for example.

[121] USEPA, ''Final Technical Support Document for HWC MACT Standards. Volume III: Selection of Proposed MACT Standards and Technologies'', July 1999. See Section 3.2.1.

reasonable values that could have been selected considering that: (1) The optimum temperature window for surface-catalyzed dioxin/furan formation is approximately 450–750°F; and (2) temperature levels below 350°F can cause dew point condensation problems resulting in particulate matter control device corrosion, filter cake cementing problems, increased dust handling problems, and reduced performance of the control device. (62 FR at 24226.)

Several commenters disagreed with our selection of 400°F as the particulate matter control device temperature limitation and stated that other higher temperature limitations were equally appropriate as MACT floor control. Based on these NODA comments, we considered selecting a temperature limitation of 450°F, generally regarded to be the lower end of the temperature range of optimum dioxin/furan formation. However, available data indicate that dioxin/furan formation can be accelerated at kilns operating their particulate matter control device at temperatures between 400–450°F. Data from several kilns show dioxin/furan emissions as high as 1.76 ng TEQ/dscm when operating in the range of 400–450°F. Identifying a higher temperature limit such as 450°F is not consistent with other sources achieving much lower emissions at 400°F, and thus identifying a higher temperature limit would not be MACT floor control.

Some commenters also state that EPA has failed to demonstrate that the best performing 12 percent of existing sources currently use temperature control to reduce dioxin/furan emissions, and therefore, temperature control is more appropriately considered in subsequent beyond-the-floor analyses. However, particulate matter control device operating temperatures associated with the emissions data used to establish the dioxin/furan standard are based on the maximum operating limits set during compliance certification testing required by the Boiler and Industrial Furnace rule. See 40 CFR 266.103(c)(1)(viii). As such, cement kilns currently must comply with these temperature limits on a continuous basis during day-to-day operations, and therefore, these temperature limits are properly assessed during an analysis of MACT floors.

Several commenters also oppose consideration of dioxin/furan emissions data from nonhazardous waste burning cement kilns in establishing the floor standard. Commenters state that pooling the available emissions data from hazardous waste burning cement kiln with data from nonhazardous waste burning cement kilns to determine the MACT floor violates the separate category approach that EPA decided upon for the two classes of cement kilns. Notwithstanding our decision to divide the Portland cement manufacturing source category based on the kiln's hazardous waste burning status, we considered both hazardous waste burning cement kiln and nonhazardous waste burning cement kiln data together because both data sets are adequately representative of general dioxin/furan behavior and control in either type of kiln. This similarity is based on our engineering judgement that hazardous waste burning does not have an impact on dioxin/furan formation, dioxin/furan is formed post-combustion. Though the highest dioxin/furan emissions data point from MACT (*i.e.*, operating control device less than 400°F) hazardous waste and nonhazardous waste burning cement kiln sources varies somewhat (0.28 vs 0.37 ng TEQ/dscm respectively), it is our judgment that additional emissions data, irrespective of hazardous waste burning status, would continue to point to a floor of within the range of 0.28 to 0.37 ng TEQ/dscm. This approach ensures that the floor levels for hazardous waste burning cement kilns are based on the maximum amount of relevant data, thereby ensuring that our judgment on what floor level is achievable is as comprehensive as possible.

We estimate that approximately 70 percent of test condition data from hazardous waste burning cement kilns are currently emitting less than 0.40 ng TEQ/dscm (irrespective of the inlet temperature to the particulate matter control device). In addition, approximately 50 percent of all test condition data are less than 0.20 ng TEQ/dscm. The national annualized compliance cost for cement kilns to reduce dioxin/furan emissions to comply with the floor standard is $4.8 million for the entire hazardous waste burning cement industry and will reduce dioxin/furan emissions by 5.4 g TEQ/yr or 40 percent from current baseline emissions.

b. What Are Our Beyond-the-Floor Considerations for Existing Sources? We considered in the April 1996 proposal and May 1997 NODA a beyond-the-floor standard of 0.20 ng TEQ/dscm based on activated carbon injection at a temperature of less than 400°F. We continue to believe that a beyond-the-floor standard 0.20 ng TEQ/dscm based on activated carbon injection is the appropriate beyond-the-floor standard to evaluate given the risks posed by dioxin/furan emissions.

Carbon injection is routinely effective at removing 99 percent of dioxin/furans for numerous municipal waste combustor and mixed waste incinerator applications and one hazardous waste incinerator application. However, currently no hazardous waste burning cement kilns use activated carbon injection for dioxin/furan removal. For cement kilns, we believe that it is conservative to assume only 95 percent is achievable given that the floor level is already low at 0.40 ng/dscm. As dioxin/furans decrease, activated carbon injection efficiency is expected to decrease. In addition, we assumed for cost-effectiveness calculations that cement kilns needing activated carbon injection to achieve the beyond-the-floor standard would install the activated carbon injection system after the normal particulate matter control device and add a new, smaller fabric filter to remove the injected carbon with the absorbed dioxin/furan and mercury.[122] The costing approach addresses commenter's concerns that injected carbon may interfere with cement kiln dust recycling practices.

The national incremental annualized compliance cost for the remaining cement kilns to meet this beyond-the-floor level, rather than comply with the floor controls, would be approximately $2.5 million for the entire hazardous waste burning cement industry and would provide an incremental reduction in dioxin/furan emissions nationally beyond the MACT floor controls of 3.7 g TEQ/yr. Based on these costs, approximately $0.66 million per g dioxin/furan removed, we determined that this dioxin/furan beyond-the-floor option for cement kilns is not justified. Therefore, we are not adopting a beyond-the-floor standard of 0.2 ng TEQ/dscm.

We note that one possible explanation of high cost-effectiveness of the beyond-the-floor standard may be due to the significant reduction in national dioxin/furan emissions achieved over the past several years by hazardous waste burning cement kilns due to emissions improving modifications. The hazardous waste burning cement kiln national dioxin/furan emissions estimate for 1997 decreased by nearly

[122] We received many comments on the use of activated carbon injection as a beyond-the-floor control techniques at cement kilns. Since we do not adopt a beyond-the-floor standard based on activated carbon injection in the final rule, these comments and our responses to them are only discussed in our document that responds to public comments.