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Lime Manufacturing Plants - Background Information for Promulgated Standards

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Emission Standards and Engineering Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Radiation
Office of Air Quality Planning Standards
Research Triangle Park, North Carolina 27711

March 1984

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U.S. Environmental Protection Agency

ENVIRONMENTAL PROTECTION AGENCY

Background Information
and Final
Environmental Impact Statement
for Lime Manufacturing Plants

Prepared by:

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(Date)

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1. The promulgated revised standards of performance will limit particulate matter emissions from rotary lime kilns to 0.6 pound per ton, and the visible emission standard has been raised to 15 percent opacity. Section 111 of the Clean Air Act (42 U.S.C. 7411), as amended, directs the Administrator to establish standards of performance for any category of new stationary source of air pollution that " . . . causes or contributes significantly to air pollution which may reasonably be anticipated to endanger public health or welfare." Lime manufacturing plants are located in all areas of the nation.

2. Copies of this document have been sent to the following Federal Departments: Labor, Health and Human Services, Defense, Transportation, Agriculture, Commerce, Interior, and Energy; the National Science Foundation; the Council on Environmental Quality; members of the State and Territorial Air Pollution Program Administrators; the Association of Local Air Pollution Control Officials; EPA Regional Administrators; and other interested parties.

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1. SUMMARY

New source performance standards for lime manufacturing plants were proposed on May 3, 1977 (Docket No. A-80-53/74-5-I-G-2; hereinafter "Docket No. A-80-53/74-5" will be omitted from the docket references in this document). Final rules were promulgated on March 7, 1978 (I-K-3). As promulgated, standards of performance for lime manufacturing plants limited particulate emissions from rotary lime kilns to no greater than 0.15 kilogram per megagram (kg/Mg) [0.30 pound per ton (lb/ton)] of limestone feed. The opacity of the exhaust gases from rotary lime kilns was limited to less than 10 percent. The particulate emission limit for any lime hydrator was 0.075 kg/Mg (0.15 lb/ton) of limestone feed.

The National Lime Association (NLA) filed a petition for review of the lime manufacturing standards with the United States Court of Appeals for the District of Columbia Circuit. On May 19, 1980, the Court of Appeals remanded the standards.

The lime manufacturing plant standards were reviewed, and on September 2, 1982, a response to the Court remand and several amendments to the standards were proposed in the Federal Register (47 FR 38832) (III-A-1). The standards of performance for lime manufacturing plants are based on the use of fabric filters or electrostatic precipitators (ESP's). Because of the costs involved in the operation of wet scrubbers as compared to fabric filters and ESP's, scrubbers were not considered best demonstrated control technology. However, the proposed remand response made it clear that the standards do not preclude the use of wet scrubbers. The proposed amendments to the standards of performance raised the particulate matter emission limit from rotary lime kilns to 0.30 kg/Mg (0.60 lb/ton) of limestone feed. The visible emission limit for exhaust

gases from rotary lime kilns remained at 10 percent opacity. The standard for hydrators was deleted. Public comment was invited.

A public hearing was held on November 18, 1982, and the public comment period was extended until December 20, 1982. Eleven speakers presented comments on the proposed remand response at the public hearing, and 13 written comments were received. These comments are summarized and responses are presented in this document, which serves as the basis for the revisions that have been made to the proposed amendments to the standards.

1.1 SUMMARY OF CHANGES SINCE PROPOSAL

In response to the public comments, certain changes have been made in the proposed amendments to the standards.

The most significant change to the proposed standards is to raise the visible emission standard from 10 to 15 percent opacity.

Another change to the proposed standards is to permit visible emission observations in lieu of continuous monitoring of visible emissions for positive-pressure baghouses. There are technical problems in obtaining accurate readings from a single continuous monitor on positive-pressure baghouses, and the cost of multiple continuous monitors is considered to be unreasonable. Thus, certified visible emission observers may be used to monitor the visible emissions of the exhaust gases from rotary lime kilns equipped with positive-pressure baghouses. Continuous monitors, however, will continue to be required for negative-pressure baghouses and ESP's.

There is also a change to the proposed standards that expands the definition of stone feed to include iron-oxide additives used in the production of iron-bearing lime because these additives become part of the final product.

The excess emission reporting frequency has been changed from quarterly to semi-annually. In addition, for rotary lime kilns that use wet scrubbers to control emissions, if the pressure drop of the scrubber is greater than 30 percent below the rate established during the performance test, this information must be reported to the Agency on a semi-annual basis.

1.2 SUMMARY OF IMPACTS OF PROMULGATED AMENDMENTS

1.2.1 Alternatives to the Promulgated Action

The regulatory alternatives are discussed in Chapter 6 of Volume I of the standards support and environmental impact statement (Volume I SSEIS) for the existing standards (EPA-450/2-77-007a). These regulatory alternatives reflect the different levels of emission control that were analyzed in determining best demonstrated technology, considering costs, and nonair quality health, environmental, and economic impacts for lime manufacturing plants. These alternatives remain the same.

1.2.2 Environmental Impacts of the Promulgated Action

The environmental impacts resulting from the existing standards are described in Chapter 6 of the Volume I SSEIS. In remanding the lime standards, the Court did not question the original analysis of economic, energy, or environmental impacts. The impacts of the amended standards, based on the original analyses, are summarized below:

The amended standards would reduce particulate matter emissions from a rotary lime kiln by about 40 percent below those allowed under a typical State implementation plan (SIP). This would result in a particulate matter emission reduction of about 1,300 tons industry wide in the fifth year following proposal. This estimate is based on a projected growth of 20 new, modified, or reconstructed rotary lime kilns in 5 years.

For rotary lime kilns, the solid waste generation industry wide in the fifth year would increase by about 0.2 percent relative to that under a typical SIP. There would be no adverse water, noise, or radiation impacts associated with these standards.

Because the amended standards would not regulate hydrators, particulate matter emissions from these sources would increase by about 140 tons annually, based on our estimate that three new hydrators will be built in the next 5 years.

1.2.3 Energy and Economic Impacts of the Promulgated Action

Energy and economic impacts resulting from the standard are discussed in Chapters 6 and 7 of the Volume I SSEIS, respectively. No changes in these impacts have occurred since the standard was proposed.

1.2.4 Other Considerations

1.2.4.1 Irreversible and Irretrivable Commitment of Resources. The regulatory alternatives defined in Chapter 6 of the Volume I SSEIS would not preclude the development of future control options nor would they curtail any beneficial use of resources. The alternatives do not involve short-term environmental gains at the expensive of long-term environmental losses. The alternatives yield successively greater short- and long-term environmental benefits, with the alternative upon which the final standards are based providing the greatest benefits. Further, none of the alternatives result in the irreversible and irretrievable commitment of resources. No change in these considerations has resulted since proposal of the standard.

1.2.4.2 Environmental and Energy Impacts of Delayed Standards. As discussed in Chapter 6 of the Volume I SSEIS, delay in the amended standards would cause a similar delay in realizing the beneficial impacts associated with the standards because enforcement of the standards was suspended upon remand of the standards. No changes in the potential effects of delaying the standards have occurred since proposal of the existing standards.

1.2.4.3 Urban and Community Impacts. Urban and community impacts of the standards are considered under economic impacts in Chapter 7 of the Volume I SSEIS. No changes in these impacts have occurred since the standards were proposed.

2. SUMMARY OF PUBLIC COMMENTS

A list of commenters and their affiliations is presented in Table 2-1. Eleven individuals representing seven lime companies, two consulting firms, and one trade association (NLA) presented oral testimony at the public hearing. In addition, 14 written comments were received, 11 of which were from organizations commenting at the public hearing. The remaining three were from two lime companies and one attorney.

The comment letters often contained several comments. Each comment is addressed separately, and the commenter is identified by the appropriate docket number.

2.1 COSTS AND BENEFITS OF THE NEW SOURCE PERFORMANCE STANDARDS

2.1.1 Costs

Comment: One commenter (IV-D-6) stated that the incremental cost effectiveness of emission reduction increases from $25 per ton of particulate matter removed for baseline SIP control to $364 per ton for the new source performance standards. The commenter contended that this increase is enormous and raises a question of whether the standard can be justified on a cost basis.

Response: The cost effectiveness of the standards is at the lower end of the range of cost effectiveness ($1,000-$3,000 per ton in 1983 dollars) associated with particulate matter control for other industries regulated by a new source performance standard. It is, therefore, considered to be reasonable.

Comment: One commenter (IV-D-2) states that the cost of preliminary collection devices (i.e., cyclones) was not included in the economic analysis of the lime plant new source performance standard. He further states that the sizes of existing ESP's and whether the ESP's are single

TABLE 2-1. LIST OF COMMENTERS[a]

No.	Commenter	Date of comment	Docket No.	Page[b] No.
ORAL TESTIMONY:				
1.	NLA (L. J. Minnick)	11/18/82	IV-F-1	7-11 105-113
2.	Dravo Lime Co. (J. Thompson)	11/18/82	IV-F-1	11-31
3.	Martin Marietta (G. Judd)	11/18/82	IV-F-1	32-39
4.	Mississippi Lime Co. (H. Shell, Consultant)	11/18/82	IV-F-1	39-46
5.	Continential Lime Co. (M. D. Roach, Consultant)	11/18/82	IV-F-1	46-65
6.	Genstar (B. McCandlish)	11/18/82	IV-F-1	66-70
7.	Edward Levy Co./Detroit Lime Co. (M. O. Johnson)	11/18/82	IV-F-1	71-77
8.	Marblehead Lime Co. (D. Garman)	11/18/82	IV-F-1	77-81
9.	Chemical Lime, Inc. (L. Rice) (comments based on experience of Dow Chemical Co.)	11/18/82	IV-F-1	81-87
10.	Marblehead Lime Co. (J. Kerwin)	11/18/82	IV-F-1	87-96
11.	Allied Products Co. (C. Dennard)	11/18/82	IV-F-1	97-105
WRITTEN COMMENTS:				
1.	Continental Lime Co. (J. B. Jordan)	10/01/82	IV-D-1	
2.	Martin Marietta Chemicals (L. C. Hanson)	10/20/82	IV-D-2	
3.	G. R. Repper, Attorney	10/20/82	IV-D-3	
4.	Tenn-Luttrell Lime Co. (J. Cardosa, Jr.)	10/29/82	IV-D-4	
5.	Continental Lime Co. (J. B. Jordan)	11/10/83	IV-D-9	
6.	Marblehead Lime Co. (J. M. Kerwin)	11/18/82	IV-G-2	
7.	National Lime Association (A. March, Attorney)	11/18/82	IV-G-3	
8.	Genstar Cement and Lime Co. (W. W. McCandlish)	12/06/82	IV-D-5	
9.	Mississippi Lime Co. (R. V. Zener, Pepper, Hamilton, and Scheetz)	12/17/82	IV-D-6	
10.	Chemical Lime Co. (L. Rice)	01/17/83	IV-G-4	
11.	Continental Lime Co. (J. B. Jordan)	01/31/83	IV-G-5	
12.	Dravo Lime Co. (J. Thompson)	01/31/83	IV-G-6	
13.	Marblehead Lime Co. (J. M. Kerwin)	02/02/83	IV-G-7	
14.	Marblehead Lime Co. (J. M. Kerwin)	02/04/83	IV-G-8	

[a]A transcript of the oral testimony presented at the public hearing and copies of all correspondence received from commenters appear in Docket A-80-53.

[b]Page numbers locate testimony within the public hearing transcript.

or multi-field units were not examined. He believes that the cost of 99.7-percent-efficient ESP's cannot be justified.

Response: In the background information document supporting the original new source performance standards (NSPS) (I-G-1), the size, design, costs, and use of preliminary collection devices (i.e., cyclones) and ESP's were analyzed. As discussed in the response to the preceding comment, the control costs are considered to be reasonable.

2.1.2 Cost and Benefits

Comment: One commenter (IV-F-1; pp. 102-103) asserted that the regulation may not result in significant environmental improvement. The commenter concluded that the regulation will consume the time, effort, and money of the Government and the industry with little tangible and measurable improvement.

Response: As recorded in the docket and discussed in the Volume I SSEIS, emission reductions of 7,200 to 10,000 tons a year are expected in 1987. Thus, there will be significant environmental improvement associated with the standards.

2.1.3 Mobility and Competition

Comment: One commenter (IV-D-6) noted that in the development of national standards, the mobility and competitive nature of the industry are evaluated to preclude the establishment of "havens" for industries in areas of less-strict pollution regulations. The lime industry is limited in mobility to sites where customers are close by because of the cost of shipping lime. This makes it impossible for an outside plant to compete with plants located close to customers. Therefore, the commenter believes that mobility and competition are not factors in the lime industry, "havens" are not an issue, and there is no justification for a national lime standard.

Response: An assessment of the mobility and competitive nature of an industry is only one of three considerations taken into account in establishing the priority of regulation for source categories. As noted in Section 2.1.4 below, lime manufacturing plants are a significant contributor and, thus, new source performance standards are appropriate.

In addition, the availability of raw materials or markets does not necessarily dictate the location of a production facility. If a market is located in or near several States with an adequate source of raw materials, a producer has the option of locating a plant in the State that most suits his needs. This gives a producer the option of locating a plant at a site that is most favorable to him with regard to environmental regulations. Therefore, there is a potential for mobility and competition in the lime industry.

2.1.4 Emissions

Comment: One commenter (IV-D-6) contends that growth in the lime industry between 1977 and 1982 was overestimated by 200 percent and, therefore, the emission impacts of the lime industry were overestimated. The commenter noted that when the lime new source performance standards were first proposed, the Administrator was directed by the Clean Air Act to include sources that may contribute significantly to air pollution. The commenter stated that under the present statute the Administrator can include a source that does cause or contribute significantly to air pollution endangering public health and welfare. Therefore, the question of whether lime does contribute significantly to air pollution should be reexamined.

Response: The precise rate of growth in an industry is not a prime consideration in developing a new source performance standard. Growth projections are used to provide estimates of the nationwide impact of new source performance standards on the industry. Growth in the lime industry is lower than originally predicted; however, significant growth has occurred. At least 16 new lime kilns have been installed in the past 5 years, and growth is expected to continue, both in additional production capacity and in replacement capacity for outmoded production facilities.

Section 111(b)(1)(A) requires the Administrator to list source categories that in his judgment ". . . cause[], or contribute[] significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare." Lime manufacturing plants meet this "significant contributor" test. The amendment of this test by the 1977 Clean Air Act Amendments was intended to ". . . emphasize the preventive

or precautionary nature of the act" and ". . . to assure consideration of the cumulative impact of all sources of a pollutant in setting . . . emission standards, not just the extent of the risk from the emissions from a single source or class of sources of the pollutant." [H. R. Rep. No. 95-294, 95th Cong. 1st Sess. at 49-50 (1977)]. The amendment does not justify delisting lime plants.

Comment: One commenter (IV-D-6) believes that the assumed baseline control level of 1.0 lb/ton was in error because lime plants may be subject to more stringent State or local emission limits. For example, the State of Missouri imposed a 0.7852 lb/ton emission limit on the commenter's facility.

Response: The baseline control level assumed in analyzing the impacts of any new source performance standard represents the average State or local control level imposed on lime plants throughout the United States. Research of State and local regulations indicated that 1.0 lb/ton of limestone feed generally represented the baseline control level imposed on new lime plants. Some plants may be subject to stricter State or local limits while other plants are subject to more lenient limits.

2.1.5 Executive Order 12291

Comment: One commenter (IV-D-6) asserted that the analysis called for by Executive Order 12291 should be done since the health benefits of new source performance standards for lime plants would not be significant. The commenter believes that the regulation of lime plant emissions, based on the absence of significant health benefits, would amount to "regulating for regulation's sake."

Response: Executive Order 12291 directs that the costs and benefits of major rules be analyzed. A rule is considered to be a major rule if (1) the national, annualized compliance costs total more than $100 million in the fifth year following adoption of the rule; (2) the standards cause a major increase in prices or production costs; and (3) the standards cause significant adverse effects on domestic competition, employment, investment, productivity, innovation, or competition in foreign markets.

The amended standards would reduce particulate matter emissions from a rotary lime kiln by about 40 percent below those allowed under a

typical SIP. This would result in a particulate matter emission reduction of about 1,300 tons industry wide in the fifth year following proposal. This estimate is based on a projected growth of 20 new, modified, or reconstructed rotary lime kilns in 5 years. The solid waste generation industry wide in the fifth year would increase by about 0.2 percent relative to that under a typical SIP. There would be no adverse water, noise, or radiation impacts associated with these standards. The fifth year annualized cost of the incremental emissions reduction from a typical SIP baseline to the level of the standards, including depreciation and interest, would be about $0.5 million (1981 dollars) assuming all rotary lime kilns use fabric filter controls. Thus, the new source performance standards for lime plants are not a major rule as defined by the Executive Order and, therefore, no regulatory impact analysis is required.

2.1.6 Health Impacts

Comment: One commenter (IV-D-6) stated that new source performance standards are based on an analysis of economic, environmental, energy, and health impacts. The commenter believes that this analysis should focus on health effects in determining the value of a standard. Because there is little evidence of adverse health effects, a legislative policy decision should conclude that national ambient air quality standards are sufficient to regulate emissions from lime plants.

The commenter stated that particulate emissions from the lime industry do not harm man and may be beneficial since they tend to neutralize acid aerosols and react quickly with water vapor and carbon dioxide to form carbonates. The commenter cited evidence to show that lime emissions do not pose adverse health impacts. The commenter also stated that the analysis supporting the new source performance standards did not point to any harmful effects from lime plant emissions but instead pointed to the alleged harmful effects of particulate matter in general.

The commenter contended that the risk assessment of particulate emissions is based on the toxicity of certain particulate species. The commenter noted that toxicity is correlated to chemical composition. The commenter contended that the chemical components of lime plant emissions are nontoxic and nonacidic.

The commenter concluded that the lime standard should be removed based on the lack of evidence that lime emissions cause significant health effects.

Response: The Clean Air Act directs that new source performance standards are to be developed for an industry if ". . . it causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare." Particulate matter is a criteria pollutant, and its impact on public health and welfare is well documented. This issue was addressed fully in the background materials associated with the original promulgation and was addressed by the Court. The Court stated:

> We think the danger of particulate emissions' effect on health has been sufficiently supported in the Agency's . . . previous determinations to provide a rational basis for the Administrator's finding in this case. Moreover, whatever its impact on public health, we cannot say that a dust "nuisance" has no impact on public welfare. (627 F.2d at 431, n. 48.)

Based on Congressional intent with respect to the Clean Air Act, the Court stated that it ". . . could not say that the Administrator's determination is arbitrary, even if the dust were shown innocuous to public health." For these reasons, new source performance standards for lime manufacturing plants are considered reasonable.

2.2 APPLICABILITY DATE

Comment: Several commenters (IV-D-2, IV-D-5, IV-D-6) believe that, because several of the Court-defined issues were amended by the September 2, 1982, proposal, the appropriate effective date for the new source performance standards should be either the date of proposal or of promulgation of the amendments.

One commenter (IV-D-6) stated that Congress intended to limit the period between proposal and promulgation to 90 days to reduce the uncertainty of companies waiting to commence construction. The applicability date of May 1977 would prolong this period to 5 years. Such a prolonged period of uncertainty goes far beyond Congressional intent.

The commenter also requested that the proposed amendment, which relaxes the rotary lime kiln particulate matter emission limit from 0.15 kg/Mg (0.30 lb/ton) to 0.30 kg/Mg (0.60 lb/ton), be treated in the

same manner as other amendments to new source performance standards for electric utility steam generators and petroleum storage tanks (i.e., the amendments should apply from the date of proposal of the amendments; they should not apply retroactively to the date of proposal of the original standards).

Response: Section 111(a)(2) of the Clean Air Act clearly states that "new sources" subject to new source performance standards are those sources which commence construction or modification after proposal of a standard of performance. New source performance standards for lime manufacturing plants were proposed on May 3, 1977 (42 FR 22506), and sources constructed or modified after that date are, therefore, new sources subject to the standard.

The fact that standards are remanded does not exempt those sources constructed or modified prior to the proposed remand response. United States v. City of Painesville, 644 F.2d 1186 (6th Cir. 1981), cert. den. 102 S.Ct. 392 (1981). Similarly, revision of standards to more accurately reflect the performance of best demonstrated technology in response to a remand does not exempt sources. See, Portland Cement Association v. Train, 513 F.2d 506 (D.C. Cir. 1975), cert. den. 423 U.S. 1025 (1975). Finally, the fact that promulgation is delayed until well after the original proposal does not, in itself, exempt sources. See, Commonwealth of Pennsylvania v. EPA, 618 F.2d 991, 1000 (3rd Cir. 1980). (See docket entry IV-B-4 for further discussion.)

Comment: One commenter (IV-D-1) stated that applying the amended new source performance standards to all sources that commenced construction after the original Federal Register proposal of May 3, 1977, would be consistent with the intent of Section 111 of the Clean Air Act, Congress, and judicial decisions. The commenter contended that if the applicability date were changed to September 2, 1982, those lime plants that commenced construction or modification between May 3, 1977, and September 2, 1982, would operate under the original new source performance standards emission limitation (0.30 lb/ton of feed), while plants that commenced construction after September 2, 1982, would operate under the amended new source performance standards (0.60 lb/ton of feed). This would

place an unfair burden on older plants and could place the older plants at a competitive disadvantage compared to plants constructed after September 2, 1982.

[This commenter later requested that the above comment letter be removed from the docket because the comment was submitted in error (IV-D-9). The commenter stated that the lime new source performance standards should apply only to sources that commence construction after September 2, 1982. However, items entered into the docket cannot be removed. Section 307(d)(4)(B)(i) provides in part that "[p]romptly upon the receipt by the agency, all written comments and documentary information on the proposed rule received from any person for inclusion in the docket during the comment period shall be placed in the docket." A memorandum to the docket can be submitted to explain an error or to amend a document.]

One commenter (IV-G-8) asked what the effects of changing the applicability date would be.

Response: The effect of a September 2, 1982, applicability date is not quite as the commenter describes. Rather, if the applicability date were changed to September 2, 1982, lime plants that commenced construction or modification between May 3, 1977, and September 2, 1982, would operate without any applicable new source performance standards. This action, although different from that contemplated by the commenter, would place lime plants that installed control equipment to meet the original new source performance standards at a competitive disadvantage compared to lime plants that did not make such an effort to comply with the standards. More specifically, the principal effect of a September 2, 1982, applicability date would be to relieve those plants which chose not to install control technology that would meet the new source performance standards from the requirement to do so. In the preamble to the proposal, comments were solicited on the applicability date in response to preproposal industry comments alleging that unreasonable impacts would occur at some lime plants if the original proposal date remained applicable. Each comment received during the public comment period was considered, and no unreasonable impacts associated with the original applicability data were identified. Therefore, the applicability date of the standards remains May 3, 1977.

2.3 BEST DEMONSTRATED TECHNOLOGY

2.3.1 Use of Wet Scrubbers

Comment: Two commenters (IV-F-1/IV-D-7, IV-D-6) stated that the choice of wet scrubbers to control particulate emissions from new rotary lime kilns is reasonable. The first commenter (IV-F-1/IV-D-7) states that a wet fan scrubber on a rotary lime kiln at a new plant subject to the new source performance standards should be considered best demonstrated technology because it is achieving the 0.60 lb/ton mass emission standard.

The second commenter (IV-D-6) stated that two kilns currently under construction should be exempt from the NSPS because: (1) scrubbers are not considered to be best demonstrated technology and this company had no choice other than to install scrubbers, and (2) the scrubbers used for their two new kilns are designed to meet the State emission limit rather than the new source performance standards because the commenter believed that no new source performance standards were in effect. The commenter maintains that there was not enough space to install an ESP or baghouse at this location; there was only sufficient room to install a scrubber. Rearranging the production area to accommodate a baghouse or ESP would be unreasonably expensive. Further, baghouses were not considered suitable for these kilns because the necessary precooling of the kiln exhaust gas stream would preclude recovery of carbon dioxide (CO_2). Electrostatic precipitators were not considered suitable because it was believed that there would be explosion hazards associated with their application to rotary lime kilns. The commenter further maintains that in the circumstances prevailing at this company, wet scrubbers must be declared the best demonstrated technology. Finally, the commenter states that operating the wet scrubbers to achieve emissions of 0.60 lb/ton would require an energy expenditure equivalent to about $1,400 per ton of additional particulate matter removed beyond the State requirement of approximately 0.78 lb/ton. This commenter believes that this additional cost is unreasonable. Therefore, the commenter believes rotary lime kilns controlled by wet scrubbers should be exempt from the new source performance standards.

Response: The new source performance standards do not require installation of any specific emission control technology. Plant operators may install any control device which meets the numerical emission limits included in the new source performance standards. Under Section 111 of the Clean Air Act, however, standards of performance must be based on the degree of emission reduction achievable through application of the best technological system of continuous emission reduction (taking into consideration the cost of achieving such emission reduction, and any nonair quality health and environmental impact and energy requirements) which has been adequately demonstrated. Analysis of the performance, costs, and other impacts associated with the use of a wide variety of emission control technologies indicates that fabric filters and ESP's represent best demonstrated technology for the control of particulate matter emissions from rotary lime kilns. Wet scrubbers are not considered best demonstrated technology because of the high energy costs associated with their use. However, venturi scrubbers have demonstrated the ability to achieve the level of the proposed standards and can be used to meet the standards. A company may choose to use a scrubber to meet the standards if it is willing to incur the high operating costs that would be associated with the pressure drop necessary to meet the standards.

In investigating and considering the situation described by second commenter, it was found that four kilns have been removed and that two larger kilns are to be installed in their place. The four kilns were bounded at each end with feedstock and product handling facilities. Because the new kilns are longer than the space that the four old kilns had occupied, the product handling facilities were moved back to accommodate the additional length of the new kilns. The product handling facilities, however, could have been moved to accommodate the space requirements of the new kilns with fabric filters or ESP's instead of just being moved to accommodate the space requirements of the new kilns with scrubbers.

The inlet gas stream to baghouses can be precooled in a variety of ways. This commenter noted that an air-to-air heat exchanger would be suitable for cooling the inlet gas stream for the purpose of CO_2 recovery but was not considered because of space limitations. As explained above, space was not a crucial limitation. Experience with an ESP on a

lime kiln in a similar industry indicates that the potential for an explosion is eliminated if automatic controls are installed that permit the exhaust to bypass the ESP when the kiln malfunctions and combustible gases are passed through the kiln. In conclusion, this company could have used a baghouse or ESP to control emissions from the new kilns. Consequently, the standards do not include an exemption for rotary lime kilns which use wet scrubbers to control particulate matter emissions.

2.4 MASS EMISSION STANDARD

2.4.1 Mass Emission Level

Comment: One commenter (IV-D-3) stated that the amended standard of 0.30 kg/Mg (0.60 lb/ton) is not justified by the data base and concludes that the appropriate emission standard for lime kilns is 0.25 kg/Mg (0.50 lb/ton). The commenter pointed out that in setting the original standard, the emission limit was about 6 percent greater than the tested emissions from the worst performer of the four plants included in the data base. The amended standard is about 30 percent greater than the worst-case controlled emission level of the five plants now included in the data base. The commenter concluded that, absent further justification, the amended particulate matter emission standard is too lenient and should be reduced from the proposed level of 0.30 kg/Mg (0.60 lb/ton) to 0.25 kg/Mg (0.50 lb/ton).

Response: The precise level at which a standard should be set to reflect use of best demonstrated technology is a matter of judgment. A level of 0.25 kg/Mg (0.50 lb/ton) could have been selected for the final standard, but the margin of safety would have been very small [about 5 percent based on a 0.25 kg/Mg (0.50 lb/ton) standard at Plant A]. It is reasonable to provide a higher margin to ensure that all new sources that install the emission control technology upon which the final standards are based will be able to meet the standard. Establishing the standard at 0.30 kg/Mg (0.60 lb/ton) provides a margin that is somewhat larger and still ensures that best demonstrated technology will be installed.

Comment: Two commenters (IV-D-5, IV-G-7) stated that the standard of 0.30 kg/Mg (0.60 lb/ton) does not consider the addition of coal emissions to total emission rates. The demand for burning coal to

manufacture lime is growing rapidly and should be considered when setting the standard. Therefore, the commenters support a 0.5 kg/Mg (1.0 lb/ton) emission limit.

Reponse: Three of the kilns tested during development of the new source performance standards were coal-fired units. Thus, the measured emissions included emissions generated by the combustion of coal in the kilns. Plants A, B, and E have coal-fired kilns, and their average emission rates were 0.23, 0.11, and 0.14 kg/Mg (0.46, 0.22 and 0.28 lb/ton), respectively. Therefore, the achievability of the standards is adequately demonstrated for coal-fired rotary lime kilns.

Comment: One commenter (IV-D-2) believes that the emission limit for rotary lime kilns may be unachievable and that the appropriate limit is 0.50 kg/Mg (1.0 lb/ton) of feed. The commenter has applied typical baghouse and ESP collection efficiencies (99.7 and 97 percent, respectively) to emission factors from "Compilation of Air Pollutant Emission Factors" (AP-42) and determined that controlled rotary lime kiln emissions from a baghouse would be 0.29 kg/Mg (0.57 lb/ton) and from an ESP would be 2.85 kg/Mg (5.7 lb/ton). The commenter notes that the AP-42 controlled lime kiln emission factor is 0.50 kg/Mg (1.0 lb/ton) of product and states that the new source performance standards require a lower value.

The commenter presented information about the allowable emission rates in the States of Ohio and Michigan. The commenter claims that the new source performance standards would require a substantial decrease in these allowable rates and would require a large investment. The commenter notes that the costs to reduce emissions increase as the emissions are reduced to zero. Therefore, the commenter believes that a standard of 0.50 kg/Mg (1.0 lb/ton) of feed would provide cleaner air and would be a compromise between existing and proposed allowable emissions.

Response: Section 111(a) of the Clean Air Act requires that standards of performance reflect " . . . application of the best technological system of continuous emission reduction which (taking into consideration the cost of achieving such emission reduction, and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated." The lime plant new source performance standards are based on performance tests of plants that

incorporate the best technological systems of control. The costs of the proposed standard were estimated for typical facilities and are considered to be reasonable. In remanding the lime new source performance standards, the Court did not question the technological basis for the standard nor the economic, energy, or environmental analyses.

AP-42 emission factors are used to project or estimate typical emissions. AP-42 values are often based on estimates or incomplete data. In contrast, the new source performance standards are based on actual tests of well-designed and well-operated modern control equipment, and the data from the tested lime plants support the achievability of the amended new source performance standards. Consequently, the standard has not been increased to 0.50 kg/Mg (1.0 lb/ton).

Comment: One commenter (IV-D-2) agrees that baghouses and ESP's can be designed to accommodate a great range of particle sizes and high gas velocities. However, the commenter notes that particle resistivity changes as the moisture content and temperature of the exhaust gas change and that any operating variable that will alter temperature or moisture content has a great effect on the collection efficiency of the ESP. He further notes that an ESP designed to handle high temperature gases cannot be operated efficiently at low temperatures.

Response: The writer's comments about sizing, moisture content, and temperature of the gas stream relative to ESP's are correct. However, they were considered and accounted for in the development of the new source performance standards as discussed in the background information document. The test data used in setting the level of the standard show that properly designed and operated control devices can achieve the standard.

2.4.2 Stone Feed

Comment: One commenter (IV-F-1, IV-G-2) stated that a few plants produce a few thousand tons each year of a product called "dead-burned dolomite." Dead-burned dolomite is a sintered or double-burned form of dolomitic quicklime, which is further stabilized by the addition of iron, that is chemically inactive and is employed primarily as a refractory for lining open-hearth steel vessels. The feed material for this product is usually about 80 percent dolomitic limestone and 20 percent iron oxide

(mill scale). The commenter noted that while dead-burned dolomite is a lime product, its components are not included within the stone feed definition in the regulation. The commenter, therefore, questioned the reasonableness of the definition of stone feed and requested that the definition be changed to include iron-oxide additives used in the production of dead-burned dolomite.

Response: It is appropriate to include the iron-oxide additive in the definition of stone feed because the iron becomes part of the final product. Therefore, the definition of stone feed has been changed to include mill scale.

2.5 THE VISIBLE EMISSION STANDARD

2.5.1 Achievability of the Opacity Standard

Comment: One commenter (IV-F-1, IV-G-6) stated that a 10 percent visible emission standard is not achievable on a continuous monitoring basis. The commenter reviewed a study of rotary lime kiln dynamics, particle composition, and particle size distribution at the control device inlet and concluded that long-term variation in visible emissions would be expected during normal kiln operation and that visible emissions data gathered to develop the standard do not reflect this variation. The study presented the theory that this variation was caused by unique properties of the hydrate particles generated prior to the baghouse that are smaller than the other dust particles generated in the kiln. The commenter stated that the visible emission standard should be attainable by a majority of lime plants, that it should consider the vagaries of normal kiln practice, and that it should be commensurate with the mass emission standard (IV-G-6, p. 38). In the absence of visible emission data taken from a number of kilns over a period of a year, the commenter believes that a reasonable standard would be 20 percent opacity.

A second commenter (IV-D-5) stated that, given the variable conditions inherent with lime and fly ash stack plumes, a visible emission limit of 20 percent opacity would be more realistic than the visible emission limit of 10 percent opacity. The commenter contended that a visible emission limit of 10 percent opacity would result in constant conflict between EPA inspectors and plant operators, costing the operators $5,000

to $7,000 per stack test to prove compliance with the mass emission standard.

A third commenter (IV-F-1, p. 40) stated that even though the 0.30 kg/Mg (0.60 lb/ton) mass emission standard was based on EPA stack tests, none of the opacity data given in Table 9 of the preamble to the proposed revision (47 FR 38852) were obtained when mass emissions were actually at the 0.30 kg/Mg (0.60 lb/ton) level. The commenter stated that the highest mass emission level recorded during testing was 0.12 kg/Mg (0.23 lb/ton).

Response: Two points mentioned by these commenters require clarification. First, compliance with the visible emission standard is not determined by continuous monitors but rather with Reference Method 9. As explained in Section 2.6 of this document, continuous monitoring data would be used to determine if the rotary kiln control device has been properly operated and maintained. Second, the highest mass emission level for a 3-test average recorded during testing was 0.23 kg/Mg (0.46 lb/ton), not 0.12 kg/Mg (0.23 lb/ton).

The first commenter's study of rotary lime kiln dynamics does provide some support for his theory that hydrate particles are formed prior to the baghouse inlet. The study does not, however, include any data about particle characteristics or concentration at the baghouse outlet, and no Reference Method 9 visible emission data were submitted. The absence of these data does not, in itself, invalidate the commenter's theory or conclusion. However, existing fabric filter theory and studies have demonstrated that particle characteristics and concentrations at fabric filter outlets are invariant over a broad range of fabric filter inlet particle characteristics and concentrations. In addition, the extensive data base supporting the visible emission standard (discussed below) covers the range of particle characteristics, concentrations, and kiln operations expected in the industry and demonstrates the achievability of a standard more stringent than that suggested by the commenter. Thus, the study's conclusions cannot be corroborated. Moreover, during the study, the fabric filter controlling emissions from the kiln under study was operated at air flows ranging from 27 to 62 percent greater than design values. This causes actual air-to-cloth ratios that are

higher than design values. The bag fabric will be stressed more than it was designed for and uncaking may occur, which could provide less than the design control efficiency. Thus, the particle behavior observed during the study may not represent behavior that would occur if the control device air flows were at design specifications.

In contrast to this study, the promulgated lime plant visible emission standard is supported by over 1,200 Reference Method 9 visible emission tests from six rotary lime kiln control device exhaust stacks for which Reference Method 5 mass emission data were gathered. Each of these Reference Method 9 visible emission tests consists of 24 individual visible emission observations made during a 6-minute period. The Reference Method 5 test data include individual tests where the mass emission levels were as high as 0.29 kg/Mg (0.58 lb/ton). The highest raw visible emission data point is 6.7 percent. After normalizing the visible emission data to a 3.0-meter (9.8-foot) stack diameter, more than 71 percent of the Reference Method 9 visible emission data exhibit opacities of 0 percent, and 99.7 percent exhibit opacities of less than 10 percent. Only 4 of the over 1,200 test data points exceed 10 percent opacity, and the maximum value is 10.6 percent opacity.

The data base that supports the final standard differs in one respect from the data base that supports the proposed standard. In October 1983, mass and visible emission data from an NSPS-subject kiln performance test at the Tenn-Luttrell Lime Company were submitted. The Tenn-Luttrell data show that the NSPS mass emission limit was achieved but the visible emission limit was not--two of the 6-minute average opacities were 10.6 percent and, thus, exceeded the standard. The visible emission data submitted by Tenn-Luttrell cannot be normalized to an equivalent stack diameter for comparison with the data from the kilns in our data base. This is because the Tenn-Luttrell baghouse compartments exhaust cleaned gases into a continuous roof monitor or monovent before the gases are exhausted in turn to the atmosphere and can be observed. The visible emission plume that exits from the monovent does not have a fixed diameter and does not exit through an aperture of known diameter such as a stack or stubstack. Without a known and constant plume diameter, the opacity values recorded for the Tenn-Luttrell baghouse cannot be normalized, and we must rely on the actual data.

The Agency analyzed the Tenn-Luttrell test report and investigated the NSPS-subject rotary kiln and baghouse. This analysis of the particulate matter emission test methods and procedures followed and data collected (IV-B-5) indicates that these methods and procedures are adequately documented, conform to the appropriate reference methods, and are calculated properly. This is also the case with the average opacity values calculated for the visible emission data. However, an examination of the visible emission observer's notes accompanying each 15-second observation indicates that about two-thirds of all of the recorded opacities originate in just 4 of the baghouse's 10 compartments. This could be an indicator of either poor air flow distribution in the baghouse or leaking bags in the four compartments.

To investigate this problem further, EPA staff visited this rotary kiln and baghouse (IV-B-8). Plant personnel agreed that there might be poor distribution of air flow in the compartments. Discussion with plant personnel served to highlight other problems that have hampered proper visible emission observations of the baghouse. It was also learned that the visible emission data contained in the test report do not represent constant visible emissions from the baghouse. Rather, during the performance test, visible emissions were evident only when each compartment was returned to operation after having been cleaned. At all other times, the baghouse had no visible emissions. However, from a design perspective, there is little to distinguish the components of this baghouse from those of other baghouses that form our data base and constitute best demonstrated technology. Moreover, plant personnel have been aggressive and thorough in their attempts to rectify all perceived problems with their baghouse.

On balance, then, the Agency has concluded that this baghouse should not be rejected as unrepresentative of best demonstrated technology. Therefore, although 99.7 percent of 1,247 average opacity values support a visible emission standard of 10 percent, it is the Agency's judgment that the level of the standard should accommodate the 10.6 percent average opacity value that is the highest observed opacity from the Tenn-Luttrell test report and the four data points from two plants in the data base of tested plants that exceed 10 percent (the maximum is a 10.6 normalized opacity).

Establishing the visible emission standard at 15 percent opacity would ensure that the visible emission limit is achievable, and it would ensure consistency with our response to the remand of the portland cement visible emission standard, in which the final standard was established based on consideration of the complete range of data from best demonstrated facilities.

The relevant variables upon which opacity depends are stack diameter, particle size, particle shape, particle refractive index, particle density, and concentration. Lime manufacturing plant stack diameter was accounted for by normalizing the raw opacity data to the largest stack diameter likely to be installed in this industry. The particle characteristics at the tested plants are representative of the industry. Although there may be some variation in the particle characteristics of the emissions from rotary lime kilns, the tested plants cover the variation likely to be found in the industry. In setting the visible emission standard, any variation is taken into account by selecting the highest 6-minute average opacity and then incorporating a reasonable margin of safety. The data base, therefore, adequately supports the selection of a 15 percent visible emission standard.

Comment: One commenter (IV-G-7) stated that there are some plants that can meet the mass emission standard but cannot comply with the visible emission standard of 10 percent opacity. The commenter stated that the mass emission limit is the real standard and that visible emissions are only a rough indicator and should include a margin of safety to account for lime plants that will have problems complying with the visible emission standard. The commenter concluded that a 20 percent opacity standard would include this margin of safety.

The commenter also submitted two stack test reports dated July 1975 and December 1978 and included photographs of visible emissions for two baghouses during the December test. The commenter stated that the emission rates for the 1975 and 1978 stack tests were 0.34 and 0.31 lb/ton, respectively, but visible emissions were near 20 percent opacity. The commenter concluded that the plant could comply with the mass emission standard but could not meet the visible emission standard of 10 percent opacity.

Response: Although the kilns and baghouses were not designed to comply with the mass emission and visible emission standards of the new source performance standards, the 1978 Reference Method 5 test report indicates that mass emissions from the baghouses were less than 0.6 lb/ton. However, no Reference Method 9 visible emission data were taken during the mass emission tests to substantiate any problems. The photographs of visible emissions from the baghouses appear to indicate visible emissions during the mass emission tests. However, accurate visible emission readings cannot be determined from these photographs, and the plume evident in the photograph appears to be a combination of two plumes from the two adjacent baghouses. Therefore, the information presented by the commenter does not provide a basis for revising the visible emission standard. As discussed previously, the visible emission standard of 15 percent opacity is based on over 1,200 Reference Method 9 visible emission tests, 99.7 percent of which exhibited less than 10 percent opacity, and none of which exceeded 11 percent opacity.

Finally, as described in Section 2.5.5 of this document, if this facility were subject to the new source performance standards and met the mass emission limit but not the visible emission limit, Section 60.11(e) of the General Provisions of 40 CFR Part 60 ensures that it would be treated equitably. This provision, upon demonstration of certain criteria (see Section 2.5.5), permits a facility that meets the mass emission standard to obtain an individual visible emission standard tailored to its unique circumstance. This individual standard is automatically approved once the facility demonstrates that it meets the requirements of Section 60.11(e).

2.5.2 Correlation of Visible Emission Data With Mass Emission Data

Comment: Two commenters (IV-F-1) assert that no correlation between mass emissions and visible emissions is obvious either from data supporting the visible emission standard or from data obtained at one commenter's company. The commenters conclude that the visible emission standard should be relaxed to a value more representative of similar processes (i.e., the 20 percent visible emission standard used by most States for chemical and mineral kilns).

Response: The comment about the correlation between mass and visible emissions requires clarification. In general, a correlation does exist between particulate matter and visible emissions. However, this correlation is demonstrated not with mass emission data (i.e., pounds of particulate matter per ton of feedstock) but rather with data on the particulate matter concentration in the exhaust gas stream from the control device.

There are situations in which it is difficult to establish a correlation between particulate matter and visible emissions. Such would be the case when much of the visible emission data consist of visible emission observations of zero percent opacity. The rotary lime kiln visible emission data present such a situation because 71 percent of the over 1,200 Reference Method 9 test results are zero percent opacity. Both because 99.7 percent of the Reference Method 9 test data are below 10 percent opacity and because of the high proportion of 6-minute averages that are equal to zero, this situation does not impugn the visible emission standard.

Although the test program that developed the data base was not designed to establish a single invariant correlation (as Portland Cement, 986 F.2d 375 [1973], points out, such a correlation is not required), an analysis of the visible emission data with respect to the particulate matter emission data has been performed, and a statistically significant correlation has been established. Furthermore, a 95 percent confidence interval was established on the regression line arising from the correlation, and this interval indicates that the maximum expected average opacity for the period of a test is less than 10 percent. The regression analysis does not include data from one observer at Plant C because this observer's opacity readings were not recorded as required by Reference Method 9. As discussed in the response in Section 2.5.1, the analysis also does not contain the data that were obtained recently from the Tenn-Luttrell Lime Company. For all of the above reasons and because of the rationale provided in Section 2.5.1, a rotary lime kiln visible emission standard of 15 percent opacity is expected to be achievable. Consequently, the visible emission standard has not been relaxed to 20 percent opacity as had been requested by the commenter.

2.5.3 Effect of Particle Size on Visible Emissions

Comment: One commenter (IV-F-1) presented four general comments about the effect of particle size on visible emissions. He stated that actual information on particle size distribution after the control device (i.e., particle size distribution in the outlet gas stream) was not examined. He also stated that particle size distribution before the control device is not a good indicator of the particle size distribution after the control device. The commenter believes that the analysis supporting the new source performance standards was based on the assumption that the particle size distribution after the control device does not include a significant number of particles whose size affects light scattering and, hence, visible emissions, and that this assumption is false. In addition, the commenter believes that visible emission levels are not a consistent predictor of a source's failure to comply with the mass emission level.

Response: It is correct that inlet (to the control device) particle size distribution is not indicative of outlet particle size distribution and that it is outlet particle size distribution that affects visible emissions. The analysis supporting the new source performance standards does not assume otherwise. The significant number of particles whose size affects light scattering is taken into account through the standardized procedures of Method 9 for observing visible emissions and through the empirical approach followed in setting standards. To account for possible variation in outlet particle size, the visible emission limit is based over 1,200 Method 9 6-minute average visible emission observations during mass emission tests at plants that are representative of the industry, normalized to a common path length of 3.0 m (9.8 ft). (See Section 2.5.1.) As discussed in the portland cement remand response, compliance with the opacity limit is a good indication of compliance with the mass emission standard.

2.5.4 Plant D Tests

Comment. One commenter (IV-F-1) quoted from the proposed preamble (47 FR 38854) as it pertained to test data from a kiln at Plant D: "Thirty-two percent of the particles emitted from this kiln were in the size range that is expected to produce the greatest light scattering, i.e., less than 2 microns. And yet Plant D easily achieved the promulgated

opacity limit and the mass emission limit." The commenter stated that the above condition was achieved because the plant operator was requested to increase the operating temperature above normal and decrease the production rate of the kiln to 70 percent of design capcity during the emission test at this facility.

Response: The plant operator at Plant D was not requested to increase the operating temperature above normal or to decrease the production rate of the kiln. The three test runs were conducted at 100, 106, and 86 percent of design capacity.

For the test in question, the inlet control device temperature ranged from 372° to 378°C (702° to 712°F) for the three test runs performed on three successive days. Near the end of the first test, the ESP inlet temperature had increased to 377°C (710°F), at which time it was noticed that visible emissions from the stack were improving. The plant chemist was asked if he could maintain the inlet temperature between 371° and 377°C (700° and 710°F) for the second test, which would start the next day. The next day the visible emissions were 0 percent opacity, and the process operator stated that the ESP inlet temperature had not dropped below 371°C (700°F) for the last 16 hours. In an earlier test program at this facility, during which no requests were made to maintain any particular temperature, the inlet control device temperature ranged from 362° to 385°C (683° to 725°F). Consequently, the fact that the inlet temperature was between 371° and 377°C (700° and 710°F) for the test in question did not cause kiln operation outside of normal operating conditions.

2.5.5 Specific Affected Facility Visible Emission Standards

Comment: Two commenters (IV-F-1) stated that variance procedures afforded lime plants that meet the mass emission standard but do not meet the visible emission standard would be burdensome, time consuming, and expensive. The commenters supported their statements by asserting that, as a purely economic issue, the $10,000 cost of proving compliance and the possibility of incurring this cost every quarter would place an undue burden on the industry.

Another commenter (IV-F-1) stated that variances for affected facilities that meet the mass emission limit but do not meet the visible emission limit imply a lack of faith in the visible emission standards.

Another commenter (IV-D-4) does not endorse the proposed procedure of requiring a lime plant to obtain a variance for the visible emission standard when the mass emission standard is being met and proposes that a visible emission standard of 20 percent opacity would be more appropriate. The commenter disagrees that new lime plants will have stack diameters less than 3.0 m (9.8 ft). This company states that it has a new plant with a stack larger than 3.0 m (9.8 ft) in diameter.

Response: The procedure referred to by the commenters does not involve a variance. Rather, Section 60.11(e) 40 CFR 60 provides that owners or operators of any affected facility from any source category that meets the mass emission standard but does not meet the visible emission standard may apply for an individual visible emission standard tailored to the unique circumstances of their facility. This standard is good for the life of the affected facility and is automatically approved upon demonstration that: (1) the facility is in compliance with the mass emission standard; (2) the facility and associated air pollution control equipment were operated and maintained in a manner to minimize the opacity of emissions during the performance tests; (3) the performance tests were performed under the conditions approved by the Administrator; and (4) the facility and associated air pollution control equipment were incapable of being adjusted or operated to meet the applicable opacity standard.

There are no costs associated with this procedure beyond those of the initial performance test and report, which are required within 180 days after startup (General Provisions § 60.8). This cost is typically $10,000 and constitutes a small fraction of a plant's annual operating budget. In view of the environmental benefits associated with the performance test procedure, the $10,000 cost is considered reasonable.

The provisions of 40 CFR 60.11(e) do not reflect a lack of confidence in the rotary lime kiln visible emission standard. Quite the contrary, the extensive data base supporting the visible emission standard indicates that recourse to these provisions will be needed rarely, if ever.

The commenter's belief that a standard of 20 percent opacity would be more appropriate is not supported by any data. As discussed previously, analysis of over 1,200 Reference Method 9 visible emission test results

collected during development of the visible emission standard support a standard of 15 percent opacity.

Available stack diameter data indicate that lime plants are unlikely to be constructed with stacks greater than 3.0 m (9.8 ft) in diameter. Although one stack with a diameter greater than 3.0 m (9.8 ft) was found in a survey of 16 new plants, the trend in the industry is toward smaller stacks or roof monitors. The one larger stack has a diameter of 5.0 m (16.3 ft), but such a diameter is considered unlikely to recur. The opacity of visible emissions will be much lower from the smaller diameter stacks than from larger stacks.

2.5.6 Reference Method 9 Accuracy and Reliability

Comment: Several commenters (IV-F-1) stated that the visible emission standard of 10 percent opacity, would be difficult to enforce. The commenters asserted that the ±7.5 percent observational error associated with visible emission reading is almost as high as the allowable opacity limit. The commenters were concerned that, because the visible emission standard is so low, it would be possible for a transmissometer to show compliance while a visible emission reader observes noncompliance. The commenters concluded that since enforcement is dependent upon visible emission readings, the standard must make allowances for the inherent inaccuracies of the visible emission reading process. The commenters further concluded that a 20 percent opacity limit would be more reasonable with respect to enforcement.

Response: The response to the portland cement plant remand discusses in great detail the reliability and accuracy of Reference Method 9 and accompanying certification techniques for determining compliance with visible emission standards. On the basis of this response, the visible emission standard included in the new source performance standards for portland cement plants was affirmed by the Court on appeal (Portland Cement Association v. Train, 513 F.2d 506).

The data gathered in responding to the remand for portland cement plants convincingly demonstrate that visible emission observers can, with a high confidence level, read the opacity of visible emissions to within a positive error not exceeding 7.5 percent during single 6-minute observations. The error tolerance is taken into account in the enforcement process, as provided explicitly by the Reference Method 9 regulations.

There are four categories of factors that can affect opacity: (1) factors related to the source category and its operations, (2) factors related to opacity observations, (3) factors considered in the determination of compliance, and (4) factors with an insignificant or non-prejudicial effect on apparent plume opacities. As discussed in detail in the "EPA Response to Remand Ordered by U.S. Court of Appeals for the District of Columbia in Portland Cement Association v. Ruckelshaus (486 F.2d 375, June 29, 1973)", factors in categories two, three, and four are taken into account in the Reference Method 9 procedures or in compliance procedures. The first category includes factors such as effluent concentration, stack diameter, mean particle size, polydispersity of emissions, refractive index, particle density, and stack gas temperature. The factors are specific to the source category and its operations and are considered in the development of visible emission standards. Although these factors can significantly affect the apparent opacity of visible emissions, the maximum expected effects of normal variations in these factors on visible emissions are used to ensure that the visible emission standard for a source category is established at a level no more restrictive than the corresponding concentration or mass standard. In addition to the above consideration of these factors, should a source have a stack of larger than expected diameter or have other anomalous operating conditions which preclude achieving the visible emission standard, the provisions of 40 CFR Section 60.11(e) allow the owner or operator to petition for establishment of an individual visible emission limit. Thus, ample consideration of the effects of these factors is provided.

The use of visible emission standards is technically sound and provides the most practical and inexpensive means to ensure that control equipment necessary for a source to meet mass standards is properly maintained and operated. Moreover, as discussed in Section 2.5.1, the visible emission standard of 15 percent opacity is based on over 1,200 Reference Method 9 visible emission tests performed concurrently with the Reference Method 5 tests that support the mass emission standard.

2.5.7 Failure To Use All Data Reviewed

Comment: One commenter (IV-F-1/IV-G-3) believes that visible emission data submitted by the Arizona Department of Health Services

were ignored. These data demonstrate that a visible emission standard of 10 percent opacity cannot be achieved.

Response: The data referred to by the commenter are for a gravel bed filter control device. Gravel bed filters were evaluated during the development of the new source performance standards; however, they were not selected as best demonstrated technology because of their high mass emission levels and costs. Also, the gravel bed filter is not representative of the control techniques used in the industry. Therefore, the test referred to by the commenter cannot be used to evaluate the achievability of the visible emission standard.

2.5.8 Miscellaneous

Comment: One commenter (IV-G-3) stated that National Lime Association (NLA) representatives were assured that a visible emission standard would be proposed commensurate with the increase in the mass emission standard.

Response: The NLA was assured that the visible emission standard would correspond to the mass emission limit, as is true for all new source performance standards. After review of over 1,200 Reference Method 9 visible emission tests that constitute the data base for the visible emission standard, the standard is considered to be commensurate with the mass emission standard.

2.6 TEST METHODOLOGY

2.6.1 Isokinetic Conditions

Comment: One commenter (IV-F-1/ IV-G-3) stated that the mass emission tests at Plants B and E were not within the isokinetic limits specified by Reference Method 5. Therefore, the commenter concluded that the tests at Plants B and E do not adequately demonstrate the achievability of the proposed standards.

Response: Sampling at probe tip velocities equal to the gas stream velocity is a condition known as isokinetic sampling. Errors in measured concentrations may occur under conditions of nonisokinetic sampling because of the inertia of some particles and may result in biased concentration measurements.

Section 6.12 of Reference Method 5 (40 CFR Part 60 Appendix A--Reference Method 5) specifies that test results are acceptable if they are within ±10 percent of isokinetic. A procedure is available to calculate the maximum error which can occur because of anisokinetic sampling. The approach accounts for the inertial effects of particulate matter and the maximum effect they might have on the measured particulate matter concentration.

The probe tip velocity during the emission testing at Plant B ranged from 93.7 to 107.0 percent of the isokinetic velocity, and the mass emission rate ranged from 0.033 to 0.11 lb/ton (Table 2-2). The velocities are within ±10 percent of isokinetic values. Therefore, the Plant B tests are considered acceptable and adequately demonstrate the achievability of the standards.

The tests at Plant E show that for four test runs, the probe tip to gas stream velocity ratios ranged from 111.2 to 117.9 percent (Table 2-2) of isokinetic. The corresponding emission rates ranged from 0.018 to 0.034 lb/ton. These emission rates were adjusted using the procedure referred to above. The adjusted emission rates ranged from 0.018 to 0.036 lb/ton (Table 2-2). Because the adjusted mass emission rates do not exceed the proposed mass emission limit of 0.60 lb/ton, data from the Plant E tests are considered to be acceptable and demonstrate the achievability of the standards.

2.6.2 Production Capacity

Comment: One commenter (IV-F-1/IV-G-3) stated that the tests at Plants C, D, and E were conducted below the design production capacity of the kilns. The commenter stated that the tests at Plant C were conducted with only two of the three available kilns in operation and that this was stated to be ". . . the normal operating mode of the plant." However, the control equipment at Plant C was designed to accommodate three kilns instead of two and, therefore, the data from the tests are invalid. The commenter further stated that Plant D was operating at 81 percent of capacity during tests. The commenter concluded that, because the tests were not conducted under conditions representative of design production conditions, the results of the tests do not adequately demonstrate the achievability of the standards. The commenter supported

TABLE 2-2. ADJUSTED PLANT B AND PLANT E TEST RESULTS

Plant	Run No.	Percent isokinetic[a]	Emission rate[a] lb/ton	Adjusted emission rate lb/ton	Decision[b]
B	1A	103.6	0.039	N.N.[c]	A
	1B	104.1	0.077	N.N.	A
	2A	99.7	0.033	N.N.	A
	2B	93.7	0.115	N.N	A
	3A	103.7	0.046	N.N	A
	3B	107.0	0.110	N.N.	A
E	1-1	96.3	0.041	N.N.	A
	2-2	112.2	0.018	0.018	A
	1-2	111.2	0.027	0.028	A
	3-1	117.9	0.024	0.025	A
	3-2	115.6	0.034	0.036	A
	2-3	108.5	0.018	N.N.	A

[a] Data from test reports.
[b] A = Accept stack test.
[c] N.N. = Not necessary.

his conclusion by citing Essex Chemical Corporation v. Ruckelshaus, 486 F.2d 427, at 436 (D.C. Cir. 1973) for the proposition that, where tests are conducted with plants operating at less than capacity, ". . . the relevancy of the test results is at best minimal."

Response: Plant C has three operating rotary lime kilns, each rated at 250 tons/day, and emissions from all three kilns are ducted to the same ESP. Plant C seldom operates all three kilns at the same time, and usually only two are on-line. In a letter dated September 4, 1974, information was requested from Plant C on operating conditions during the May 1974 tests and on any nontypical conditions. Plant C responded on October 8, 1974, stating that two kilns were in operation during the test and that operation on these dates was normal. There is no indication that operation of two rather than three kilns at Plant C is abnormal. Therefore, the operation of two kilns is considered to be the normal operating mode of Plant C.

Emission testing is usually conducted at the maximum production rate for a given plant, which, in most cases, is within approximately 10 to 15 percent of design capacity. During the emission testing at Plant D, the production rates ranged from 86 to 106 percent of design capacity (I-G-1, p. C-5). [The 81 percent stated by the commenter is an error.] Although the tests at Plant D were conducted at -14 percent to +6 percent of design capacity, the test results show that the emission levels between test runs in both Plant D tests were consistent, averaging 0.275 lb/ton. Emission testing at Plant E was performed at 91 percent of capacity. Consequently, the test results at Plants D and E are considered valid.

The Essex Chemical Corporation case cited by the commenter refers to a situation where testing was performed at 52 percent of capacity and, as the Court stated in the remand of the lime manufacturing plant new source performance standards, the regulations there in question, unlike those for lime plants, expressly required performance tests while the affected facility operated at the maximum pollutant production rate. Thus, the case is not relevant to this situation.

2.6.3 Pitot Tube Specifications and Velocity Traverses

Comment: One commenter (IV-F-1/IV-G-3) stated that there were errors in the Plant E emissions tests:

1. The pitot tubes were not within the specified pitot coefficient (C_p) range of 0.85 ± 0.02, but instead were 0.807 and 0.819.

2. Reference Method 1 specified 24 points per traverse (48 total sample points) for stacks of this configuration, while 22 points per traverse (44 total sample points) were sampled.

The commenter further stated that the errors would have a profound effect on the test data. Therefore, the Plant E tests do not adequately demonstrate the achievability of the standard.

Response: Reference Method 2 states that the type-S pitot tube shall have a known coefficient, determined by one of the procedures outlined in the method. The 0.85 coefficient noted by the commenter is a nominal coefficient used to set up the nomograph used for establishing isokinetic sampling rates during an actual test. Where the exact pitot coefficient is known, the method specifies it must be used in the equations provided, in place of the nominal 0.85 coefficient, to determine the actual test run isokinetic rate. The contractor who tested Plant E supplied calibrated pitots for this work, and the procedure outlined in the method was followed. The minor variations between the nominal coefficient used in the nomograph and the actual coefficients used in the calculations accounted for the nonisokinetic sampling rates for the tests.

Sampling too close to the stack wall (i.e., within 1 inch) can bias the sample because of flow turbulence and, thus, as in the case of Plant E, sampling is not conducted when the probe is near the wall. A report entitled "Particulate Sampling Strategies for Large Power Plants Including Nonuniform Flow" examines the errors incurred by changing the number of sampling points for stack gas particulate sampling. It demonstrates that the expected error in measurement of particulate concentration decreases as the total number of sample points over 24 increases. The largest expected error for 24 or more sample points is less than 1.0 percent. For Plant E, the decrease in the total number of sample points from 48 to 44 cannot be expected to change the emission

rate determination by more than about 1 percent. Thus, these errors would not have a significant effect on the test data because the highest Plant E emission rate, adjusted for error as noted in Section 2.5.4.1, was 0.036 lb/ton.

2.6.4 Climatic Conditions

Comment: One commenter (IV-F-1) stated that the statement in the proposal preamble that ". . . stack gas exit velocity is not an independent variable because it depends on the gas flow rate and stack diameter . . ." is erroneous. He indicated that excess moisture is present in the gas stream during the winter months as a result of the feedstock laden with snow and ice that is added to the kiln. The commenter states that this moisture increases the stack gas velocity and, thus, increases visible emissions.

Response: The velocity of the gas stream is dependent on the gas flow rate and the stack diameter. The addition of moisture to the gas stream will increase the volume (cubic feet) and, thus, the gas flow rate (cubic feet per minute). The velocity at which the gas stream moves through the viewer's line of vision has no effect on the opacity of visible emissions. The commenter appears to be indicating that an increase in moisture content during some months of the year in certain geographical areas would increase the visible emissions of the exhaust gas stream. Although the addition of moisture could increase the apparent opacity of visible emissions under certain conditions, Reference Method 9 has specific procedures for the reading of plumes with high moisture contents. These procedures require reading of the plume at the point of dissipation of the moisture. Thus, compliance with the standards is not adversely affected by the addition of moisture to the plume.

The capacity of a kiln is a function of its evaporative load. Addition of large quantities of water to the kiln would decrease the capacity. Thus, the mass emissions would be expected to decrease. Consequently, the visible emissions should decrease or remain at about the same level.

2.7 CONTINUOUS MONITORING

2.7.1 Continuous Monitoring Reliability

Comment: One commenter (IV-F-1) stated that transmissometers necessary to fulfill the continuous monitoring requirement are subject to a high frequency of false readings and require excessive maintenance. The commenter concluded that continuous monitoring is unachievable because there does not seem to be any instrumentation that can provide reliable continuous monitoring.

The commenter further stated that imposing three monitoring requirements--Reference Method 5, Reference Method 9, and continuous opacity monitoring--amounts to overkill. Therefore, the commenter recommended that the continuous monitoring requirement be deleted from the regulation.

The commenter also felt that wet scrubbers should have the same visible emission monitoring requirements that fabric filters and ESP's have.

Response: Studies indicate that continuous monitors are in operation in many industries, and when they comply with the performance specifications included in 40 CFR 60, Appendix B, these monitors perform accurately and reliably.

Reference Methods 5 and 9 are test methods to determine compliance with standards of performance. They are not performed on a continuous basis (although for facilities that choose to use certified visible emission observers instead of transmissometers for monitoring positive-pressure fabric filters, Method 9 could be said to be used on a continual basis). Thus, the requirement to monitor visible emissions (or pressure drop and liquid flow rate in the case of wet scrubbers) is the only "monitoring" requirement. This requirement is considered reasonable because continuous monitoring provides the information necessary to ensure proper operation and maintenance of the control system. Without continuous monitoring, neither the plant operator nor enforcement personnel can determine whether control equipment is operating properly or is in need of maintenance without costly performance testing to determine compliance with the standard.

Scrubbers are not subject to the lime plant visible emission standard because the formation of steam plumes from scrubbers makes it difficult to accurately determine plume opacities. It is difficult to determine where the steam plume from a scrubber on a rotary lime kiln actually dissipates and the visible emissions begin. However, the pressure drop and liquid flow rate monitoring and recording requirements will ensure that scrubbers are operated and maintained properly.

Comment: One commenter (IV-D-5) contends that the most reliable system to verify compliance with the standard would be a realistic visible emission standard rather than a continuous monitoring system. The commenter also stated that the requirement to record readings from a continuous monitor should be dropped because it is an unfair burden.

Response: The cost of continuous monitoring (or pressure drop and liquid flow monitoring in the case of wet scrubbers) on other than positive-pressure fabric filters is small (about $5,000 annually). The data gathered by continuous monitors are necessary to indicate problems in operation and maintenance of the control device. Consequently, collecting and recording these data do not impose an unreasonable burden. As discussed in Section 2.5.1, the 15 percent visible emission standard is reasonable.

2.7.2 Use of Continuous Emissions Monitoring Results

Comment: One commenter (IV-F-1) was concerned about whether transmissometer data would be used by enforcement personnel as evidence of noncompliance with the standards.

Response: The continuous monitoring results are not used to determine violations of the standards under the federal NSPS. The purpose of the continuous monitoring requirement is to provide plant operators and enforcement personnel with information about whether a control device is properly operated and maintained. If the data recorded by the transmissometer indicate visible emissions approaching or exceeding the visible emission standard, then plant operators are forewarned that the control device needs maintenance. Although transmissometers are not the method used to determine compliance, data generated by the transmissometers are used to cite plants for failure to properly operate and maintain the equipment. In addition, to the extent that continuous monitoring data

indicate visible emissions in excess of the standard over a period of time, an enforcement agency may require a plant to perform a performance test to determine compliance with either the mass emission standard or the visible emission standard.

2.8 MISCELLANEOUS

2.8.1 Temperature of Lime Production

Comment: One commenter (IV-F-1) stated that some important facts were not addressed in the preamble (47 FR 38851) in the discussion of particle sizes at various stages in the production of lime. The commenter stated that calcining lime by going from 1000°C (1832°F) to 1648°C (2998°F) as the preamble indicated would ruin the quality of the lime.

Response: The discussion on temperature, referred to by the commenter, is included in the preamble only to show how particle sizes tend to increase with increasing process temperature. This information was obtained from "Chemistry and Technology of Lime and Limestone" by R. S. Boynton (Interscience Publishers, 1967) (II-I-4). Boynton states that as the temperature in the kiln increases to 1000°C (1832°F), the 0.1-μm crystals coalesce into larger particles of approximately 1 μm in diameter. At 1100°C (2012°F), these coalesced lime particles are irregular spheres greater than 1 μm, and at 1648°C (2998°F) (the temperature required for the sintering of dead-burned lime), the particles are approximately 100 μm in diameter. This discussion does not imply that the calcining process is normally run from 1000° to 1648°C (1832° to 2998°F).

2.8.2 Continuous Monitoring of Positive-Pressure Fabric Filters.

Although not specifically mentioned by any commenters, there may be some difficulties associated with the use of continuous monitors on positive-pressure fabric filters. Positive-pressure fabric filters have either multiple exhaust points or a single exhaust point running the length of the fabric filter. To monitor visible emissions adequately, continuous monitors must be mounted at each emissions point or a single monitor must be positioned to monitor the visible emissions across a single "line of sight." In some instances, the distance to be traversed by the beam from a single monitor positioned on the "line of sight" exceeds the

capability of the monitor. Thus, in these cases, multiple monitors would be required to monitor visible emissions adequately on a positive-pressure fabric filter. Installation of these monitors greatly increases both the capital and operating costs required to monitor visible emissions, and these increased costs are considered to be unreasonable.

In lieu of transmissometers, observations of visible emissions discharged to the atmosphere from positive-pressure fabric filters can be employed on a routine basis to ensure proper operation and maintenance of the control device. The final standards, therefore, require that if a continuous monitor is not installed on a positive-pressure fabric filter, a certified visible emission observer must monitor and record the opacity of visible emissions from each compartment or exhaust point once per day during normal kiln operation. For each site of visible emissions, three 6-minute observation sets must be performed in accordance with Reference Method 9. Reference Method 9 is used to determine compliance with the control device visible emission standard. Accordingly, reports of such tests from positive-pressure fabric filters may be used to determine compliance with the control device visible emission standard. The monitoring requirements for control devices other than positive-pressure fabric filters remain unchanged.

In addition to reevaluating these continuous monitoring requirements, the Agency has examined the monitoring and reporting requirements for wet scrubbers. Wet scrubbers are not subject to the visible emission standard, but they are subject to requirements for monitoring and recording of the pressure drop and liquid flow rate. The purpose of these requirements is to provide a means for the EPA and owners of facilities controlled with scrubbers to ensure proper operation and maintenance of the scrubber. To be consistent with this purpose and with the requirement that visible emissions from other control devices in excess of the standard be reported on a quarterly basis, the Agency is adding a performance specification and reporting requirement for wet scrubbers. Section 60.343(e) of the regulation requires that any periods during which the scrubber pressure drop is greater than 30 percent below the rate established during the performance test be reported to the Agency on a semi-annual basis. The

Agency has decided that all excess emission reports will be required semi-annually rather than quarterly.

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

Standards of performance for the control of particulate matter emissions from rotary lime kilns at new, modified, or reconstructed lime manufacturing plants are being promulgated under the authority of Sections 111, 114, and 301(a) of the Clean Air Act, as amended. These standards would apply to those affected facilities that commence construction on or after May 3, 1977, the date of original proposal. This document contains a summary of the public comments on the proposed revised standards and the EPA's responses, as well as summary economic and environmental impact statements.

17. KEY WORDS AND DOCUMENT ANALYSIS

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