

BACKGROUND INFORMATION FOR PROPOSED NEW SOURCE PERFORMANCE STANDARDS:

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Asphalt Concrete Plants
Petroleum Refineries
Storage Vessels
Secondary Lead Smelters and Refineries
Brass or Bronze Ingot Production Plants
Iron and Steel Plants
Sewage Treatment Plants

Volume 1, MAIN TEXT

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ENVIRONMENTAL PROTECTION AGENCY

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BACKGROUND INFORMATION FOR PROPOSED NEW SOURCE PERFORMANCE STANDARDS:



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Secondary Lead Smelters and Refineries
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Sewage Treatment Plants**

Volume 1, MAIN TEXT

**U. S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Water Programs
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711
June 1973**

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ABSTRACT

This document provides background information on the derivation of the proposed second group of new source performance standards and their economic impact on the construction and operation of asphalt concrete plants, petroleum refineries, storage vessels, secondary lead smelters and refineries, brass or bronze ingot production plants, iron and steel plants, and sewage treatment plants. Information is also provided on the environmental impact of imposing the standards on new installations.

The standards developed require control at a level typical of well controlled existing plants and attainable with existing technology. To determine these levels, extensive on-site investigations were conducted, and design factors, maintenance practices, available test data, and the character of stack emissions were considered. Economic analyses of the effects of the proposed standards indicate that they will not cause undue reductions of profit margins or reductions in growth rates in the affected industries.

CONVERSION FACTORS BRITISH TO METRIC UNITS

Multiply	By	To obtain
barrels	1.59×10^{-1}	cubic meters
cubic feet	2.83×10^{-2}	cubic meters
degrees Fahrenheit*	5/9	degrees Celsius (centigrade)
gallons	3.79×10^{-3}	cubic meters
grains	6.48×10^{-5}	kilograms
inches of water †	2.49×10^2	newtons per square meter
pounds	4.54×10^{-1}	kilograms
pounds per square inch	6.89×10^3	newtons per square meter
square feet	9.29×10^{-2}	square meters
tons (short, 2,000 pounds)	9.07×10^2	kilograms
long tons (2,240 pounds)	1.02×10^3	kilograms

*To obtain Celsius (centigrade) temperatures (t_c) from Fahrenheit temperatures (t_f), use the formula: $t_c = (t_f - 32)1.8$.

†Multiply millimeters of mercury by 1.33×10^2 to obtain newtons per square meter.

BACKGROUND INFORMATION FOR PROPOSED NEW SOURCE PERFORMANCE STANDARDS

INTRODUCTION

This document provides background information on the derivation of the proposed second group of new source performance standards and their economic impact on the construction and operation of asphalt concrete plants, petroleum refineries, storage vessels, secondary lead smelters, and bronze ingot production plants, iron and steel plants, and sewage treatment plants. The regulation for the proposed standards, published in the *Federal Register* under Title 40 CFR Part 60, is being distributed concurrently with this document. The information presented herein was prepared for the purpose of facilitating review and comment by owners and operators of affected facilities, environmentalists, and other concerned parties prior to promulgation of the standards.

Information concerning the source categories is provided in Technical Reports 6 through 13. In the case of petroleum refineries, there are reports covering two affected facilities—catalyst regenerators and gaseous fuel burning. Technical Reports 1 through 5 were published in 1971 with the first group of new source performance standards.

The performance standards were developed after consultation with plant owners and operators, appropriate advisory committees, trade associations, equipment designers, independent experts, and Federal departments and agencies. Review meetings were held with the Federal Agency Liaison Committee and the National Air Pollution Control Techniques Advisory Committee. The proposed standards reflect consideration of comments provided by these committees and by other individuals having knowledge regarding the control of pollution from the subject source categories.

The National Air Pollution Control Techniques Advisory Committee consists of 16 persons who are knowledgeable concerning air quality, air pollution sources, and technology for the control of air pollutants. The membership includes State and local control officials, industrial representatives, and engineering consultants. Members are appointed by the Administrator of the Environmental Protection Agency (EPA) pursuant to Section 117(d), (e), and (f) of the Clean Air Act Amendments of 1970, Public Law 91-604. In addition, persons with expertise in the respective source categories participated in the meeting of the Advisory Committee.

The Federal Agency Liaison Committee includes persons with knowledge of air pollution control practices as they affect Federal facilities and the nation's commerce. The committee is composed of representatives of 19 Federal agencies.

The promulgation of standards of performance for new stationary sources under Section 111 of the Clean Air Act does not prevent State or local jurisdictions from adopting more stringent emission limitations for these same sources. In heavily polluted areas, more restrictive standards, including a complete ban on construction, may be necessary in order to achieve National Ambient Air Quality Standards. Section 116 of the Act provides specific authorization to States and other political subdivisions to enact such standards and limitations.

SPECIAL NOTE

Subsequent to the development of this document, the Environmental Protection Agency adopted a policy of expressing standards in the metric rather than the English system. Consistent with the proposed standards, emission limits are listed herein in metric units, but English equivalents are also provided. Due to the complexities involved in recalculating test results, data in this document have not been converted from the English to the metric system. A table of conversion

factors is presented in the preliminary pages, however. To allow comparison with test data, the standards are frequently referenced in terms of English units.

GENERAL CONSIDERATIONS

The proposed second group of new source standards includes emission limits for particulates (including visible emissions), as well as sulfur dioxide, carbon monoxide, and hydrocarbons. In addition, revisions have been incorporated into the General Provisions that were published with the first group of standards under Title 40 CFR 60. Methods for determining compliance with particulate and sulfur dioxide limits are published in the Appendix of 40 CFR 60. Methods for measuring carbon monoxide and hydrogen sulfide are published with the proposed standards.

Development Procedures

The procedures used to develop the standards were similar for all source categories. In every case, a screening process was followed to appraise existing technology and to determine the locations of well controlled sources. Extensive on-site investigations were conducted to identify sources that appeared to be the best controlled and amenable to stack testing. Design features, maintenance practices, available test data, and the character of stack emissions were considered. Where particulate emissions were contemplated, appreciable weight was given to the opacity of stack gases. In most instances, the facilities chosen for testing were those that exhibited little or not visible emissions and had a sufficient length of straight ductwork downstream of the collector to obtain representative source samples.

Observations of stack gases during the screening process and during stack tests furnished the basis for the proposed visible emission limits. For most of the six particulate standards, several sites that met the proposed visible emission limits were identified. Mass emissions from many of them could not be measured because the stack configurations precluded accurate testing. Those sources that met the proposed mass particulate limits also met the visible emission limits. Thus, visible emissions in excess of the proposed limits indicate that the mass particulate standards are also being exceeded.

Condensed water vapor is not considered a visible emission for purposes for this regulation. Where the presence of uncombined water is the only reason for failure to meet the standards, such emissions shall not be considered a violation.

This volume contains sufficient data from the tests conducted to support the discussions. Detailed test data are given in Volume 2 of this document, which was prepared in a limited edition but is available to those who need the data. The second volume can be obtained from the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin.

Limits in Terms of Concentration

Most of the emission limits included in this group of standards are being proposed in terms of pollutant concentration. Particulate limits, for example, are being proposed in terms of milligrams per normal cubic meter of undiluted exhaust gases. This is a deviation from the first group of performance standards, wherein most of the limits were promulgated in terms of mass per unit of production, feedstock, or fuel input. The change to concentration units is a result of discussions with control officials, representatives of affected industries, and others knowledgeable in the field. Its purpose is to facilitate compliance testing and enforcement of new source performance standards. Establishing standards in this form obviates the need to determine such things as production rates and burning rates, which often cannot be ascertained with the same degree of accuracy as can the pollutant concentration. In some future standards, a pollutant concentration limit may not be feasible, and other types of standards may be used.

In proposing concentration limits, it is implicit that compliance cannot be achieved by merely diluting exhaust gases with ambient air. Emission limits are to be achieved through the application

of process changes or remedial equipment that will limit the discharge of pollutants to the atmosphere. The concentration limits proposed in these regulations will apply to exhaust gas streams as they are discharged from control equipment. If there is any dilution prior to measurement, suitable corrections will be made in determining compliance. Provisions have been incorporated in each standard that preclude dilution as a means of achieving the standard.

The provisions regarding circumvention by dilution, for example, 60.94(c), apply equally to mass limits and visible emission limits. Where dilution gases are added downstream of air pollution control devices, owners or operators will be required to demonstrate that the visible emissions would not constitute a violation of the standard if they were not diluted.

Compliance Testing and Instrumentation

As with the first group of new source performance standards, particulate limits in the proposed regulation are based on material collected in the probe and filter of the EPA sampling train (see "Test Methods" section). Impingers, as described in the original proposal for Group 1 source categories (40 CFR 60), may be utilized; however, the material collected in the impingers is not considered particulate for purposes of the proposed regulations.

Emissions of hydrocarbons from storage vessels for petroleum liquids will not be measured directly. This standard is established in terms of emission limitations that can be accomplished with readily available and standardized control equipment, i.e., floating-roof tanks, vapor recovery systems, and conservation vents. The standard specifies that these devices or any other device equally effective for hydrocarbon control shall be utilized. The actual emissions from any specific storage vessel can be determined by utilizing suitable empirical relationships developed by the industry.

While the limits for refinery fuel gases are designed to prevent the release of sulfur dioxide, it is expected that, in essentially all cases, compliance will be determined by analyzing the hydrogen sulfide content of the fuel gases before they are burned.

The carbon monoxide measurement technique is based on an instrumental method of analyses of exhaust gases. Instruments specified in the proposed regulations or instruments of essentially the same type may be utilized to satisfy this requirement. Owners and operators of petroleum catalyst regenerators may monitor either carbon monoxide or two other significant parameters, oxygen content and temperature. If they can show by monitoring that there is sufficient oxygen in the gas stream to provide the necessary degree of carbon monoxide combustion at the firebox temperature, carbon monoxide monitoring will not be required.

In addition to instruments for the measurement of carbon monoxide and the sulfur content of fuel, instruments will be required, where feasible, to measure emissions directly or indirectly. Instruments for recording visible emissions will be required for two source categories for which particulate limits are proposed.

Use of Alternative Test Methods

A provision has been added whereby the Administrator may accept performance tests conducted with alternative methods that are not entirely equivalent to the reference method but are sufficiently reliable that they may be used for certain applications. For example, an alternative test method that does not require traversing during sampling for particulate matter may be approved if such method includes a suitable correction factor designed to account for the error that may result from failing to traverse, or if it can be demonstrated in a specific case that failure to traverse does not affect the accuracy of the test. Similarly, use of an in-stack filter for particulate sampling may be approvable as an alternative method if the method otherwise employs provisions designed to result in precision similar to the compliance method, and a suitable correction factor is included to account for variation between results expected due to filter location. In cases where determination of compliance using an alternative method is disputed, use of the reference method or its equivalent shall be required by the Administrator.

Waiver of Compliance Test

A provision has been added whereby the Administrator may waive the requirement for compliance testing if the owner or operator provides other evidence that the facility is being operated in compliance with the standard. Evidence of compliance may be in the form of: tests of similar installations and measurement of significant design and operating parameters; observations of visible emissions; evaluation of fuels, raw materials, and products; and other equally pertinent information. The Administrator will reserve the authority to require testing of facilities at such intervals as he deems appropriate under Section 114 of the Act.

Comparisons with State and Local Regulations

In this background document, the proposed new source performance standards frequently are compared to existing State and local regulations. Process weight regulations are commonly employed by many State and local jurisdictions to limit particulate emissions from a variety of industrial sources. In this type of regulation, allowable particulate release is based on the size of the source. The limit, however, varies from state to state. Consequently, a reference process weight curve is used for comparison purposes. The reference curve was published as part of an EPA regulation on the preparation of State implementation plans (40 CFT 51); its limitations are given in Table 1.

Table 1. REPRESENTATIVE DATA FROM PROCESS WEIGHT CURVE

Process weight rate, lb/hr	Allowable emission rate, lb/hr
50	0.03
100	0.55
500	1.53
1,000	2.25
5,000	6.34
10,000	9.73
20,000	14.99
60,000	29.60
80,000	31.19
120,000	33.28
160,000	34.85
200,000	36.11
400,000	40.35
1,000,000	46.72

Emissions, E, for process weights up to 60,000 lb/hr not corresponding to the points given in Table 1 can be interpolated by the equation:

$$E = 3.59 P^{0.62} \quad (1)$$

where:

E = emissions, lb/hr

P = process weight, lb/hr

For process weights above 60,000 lb/hr, interpolation and extrapolation are based on the equation:

$$E = 17.31 P^{0.16} \quad (2)$$

Environmental Impact

All of the proposed standards have the effect of reducing emissions of air pollutants to the atmosphere. They may also cause an increase in the generation of solid wastes and in some instances produce liquid wastes.

Six of the standards require control of particulate matter that thereby becomes a potential solid waste. Nonetheless, it is significant that all six source categories are required by existing State and local regulations to control particulates to some degree. The effect of the proposed standards is to require the installation of higher efficiency dust collectors and thus to increase the quantity of collected solids. In no case is a new type of solid waste created. Some of these collected particulates, e.g., those from secondary lead furnaces and many asphalt concrete plants, can be recycled back to the system. In others, such as steel furnaces and sludge incinerators, the material must be disposed of, usually in landfills. None of the materials collected from these facilities are of such nature that they cannot be successfully handled by landfill.

It is expected that most of the devices installed to meet the proposed standards will collect the material in the dry state. Dry collection is advantageous because (1) it greatly reduces the possibility of water pollution and (2) the collected material is more likely to be acceptable for recycle to the process. Dry dust collectors are feasible with all six source categories, but scrubbers are more likely to be utilized for basic oxygen process steel furnaces (BOPF) and sewage sludge incinerators. In addition, some owners and operators of asphalt concrete plants and secondary lead smelters may choose to utilize wet scrubbing systems rather than dry dust collectors. Since wet scrubbers have been used extensively in the steel industry and for asphalt concrete plants and sewage sludge incinerators, techniques are available for recycle of water and for acceptable disposal of solid wastes. The proposed standards will not require the use of any solid waste or water treatment practices that are not already utilized to a wide degree. It may increase the complexity and cost of liquid and solids handling because of the greater quantities of particulate collected.

The proposed standards also require the collection of hydrocarbons and sulfur compounds. There are no potential adverse effects of the hydrocarbon storage regulation since all hydrocarbons are retained as product or recycled to petroleum refineries.

Sulfur compounds are recovered as salable by-products, usually elemental sulfur or sulfuric acid. The most common process generates a liquid waste for which acceptable disposal methods are available. The process has been in use for many years in the petroleum and natural gas industry.

Economic Impact

For each of the designated source categories, information is provided on the expected economic impact of the standard on the industry. Capital and annualized costs (including operating costs) have been estimated. In addition, the incremental costs of air pollution control on the typical product have been determined. A summary of pertinent cost items for typical affected source categories is provided in Table 2.

Provisions for Startup, Shutdown, and Malfunction

Independent of this proposal, the Administrator published on May 2, 1973, a proposed amendment to 40 CFR 60, Subpart A—General Provisions, whereby consideration will be given to conditions that may cause emissions to exceed new source standards during startup, shutdown, and malfunction. The new provisions are tentative pending a review of the comments and promulgation of the resulting provision.

NOMENCLATURE

The following lists of abbreviations, definitions, test methods, and control equipment should help clarify the terms used in the background document text and graphs.

Table 2. SUMMARY OF COST ESTIMATES

Proposed standard			Basis for cost analysis		Estimated cost		
Industry	Affected facility	Performance standard	Typical facility size	Control equipment	Investment cost, \$	Annual cost, \$/yr	Impact ^a
Asphalt concrete plants	Entire facility	70 mg/Nm ³ (particulates)	150 tons/hr	Fabric filter or venturi scrubber	63,000	18,000	\$0.16/ton of product
					56,000	21,000	\$0.19/ton of product
			300 tons/hr	Fabric filter or venturi scrubber	92,000	26,000	\$0.12/ton of product
					95,000	36,000	\$0.16/ton of product
Petroleum refineries	FCC catalyst regenerator	50 mg/Nm ³ (particulates)	20,000 bbl/day	Precipitator	700,000	150,000	\$0.022/bbl of fresh feed
			65,000 bbl/day	Precipitator	1,150,000	225,000	\$0.010/bbl of fresh feed
Hydrocarbon storage vessels	Storage tanks	0.050 volume % ^b (carbon monoxide)	80,000 bbl	Floating-roof tank	27,000 (incremental) over a fixed roof)	3,800	Gasoline- (\$11,100/yr) ^e Jet naphtha- \$1,000/yr Crude oil- (\$5,200/yr)
		230 mg/Nm ³ of fuel gas (hydrogen sulfide)					
Secondary lead	Furnace emissions	50 mg/Nm ³ (particulates)	50-ton/day reverberatory furnace	Fabric filter or venturi scrubber	188,100	50,600	\$1.65/ton of product
					125,200	35,600	\$2.85/ton of product
			50-ton/day blast furnace	Fabric filter or venturi scrubber plus afterburner	156,600	50,600	\$4.05/ton of product
Brass and bronze Iron and steel	Furnace emissions Basic oxygen furnace	50 mg/Nm ³ (particulates) 50 mg/Nm ³ (particulates)	50 ton/day	Fabric filter	110,000	20,070	\$6.38/ton of product
			140 tons/melt	Open-hood scrubbing	5,720,000	1,946,000	\$1.17 to \$1.67/ ton of steel
				Precipitator	5,880,000	1,492,000	
				Closed-hood scrubbing	6,760,000	2,139,000	
			250 tons/melt	Open-hood scrubbing	7,400,000	2,139,000	\$0.89 to \$1.22/ ton of steel
	Precipitator	8,000,000	2,025,000				
Sewage treatment	Sludge incinerator	70 mg/Nm ³ (particulates)	10 ton /day	Venturi scrubber (low energy)	60,000	11,700	\$0.12/person/yr

^aEstimated product prices: (1) asphalt concrete—\$6/ton, (2) brass and bronze—\$1100 to \$1200/ton, (3) iron and steel—\$220/ton (price of finished steel products for a typical mill product mix), (4) secondary lead—\$320/ton.

^bCarbon monoxide boilers have an attractive economic payout, and, as a result, most new units would be built with such boilers even without the proposed standards.

^cIt is commonly accepted and necessary practice to treat the various refinery gas and liquid streams for product quality control. Consequently, there is a 2 to 5 percent increase in investment cost but no discernable difference in operating costs between current industry practice and the requirements for new source standards.

^dFloating-roof tanks are required for storage of liquids with vapor pressures between 1.52 and 11.1 psia. Storage of liquids with vapor pressures above 11.1 psia requires use of recovery or equivalent.

^eFigures shown are net costs and include a credit for recovered materials. Figures in parenthesis indicate a savings.

Abbreviations

acf	— actual cubic feet; volume of gas at stack conditions
acfm	— actual cubic feet per minute
bbl	— barrels
dscf	— dry standard cubic feet
dscfm	— dry standard cubic feet per minute
°F	— degrees Fahrenheit
ft ²	— square feet
gal	— gallons
g/Nm ³	— grams per normal cubic meter
gr	— grains
hr	— hours
lb	— pounds
min	— minutes
ou	— odor units
ppm	— parts per million by volume
psia	— pounds per square inch absolute
scf	— standard cubic feet
scfm	— standard cubic feet per minute

Definitions

Front half	— Material captured in probe and filter of EPA train (see test method 2). Also called "dry filterable particulate."
Back half	— Material captured in the impinger portion of the EPA train. Also called "condensables."
Total EPA train	— Front half plus back half catch (see test method 1).
Average	— Arithmetic average of the individual runs.

Code Methods

The following code methods are referred to by number in the technical reports:

1. EPA train with impingers—Isokinetic sampling and traversing of the stack, with analysis of the probe washings, filter catch, impinger washings, organic extraction, and impinger water.
2. EPA method 5 (as described in the December 23, 1971, *Federal Register*)—Isokinetic sampling and traversing of the stack; analysis includes only probe washings and filter catch (also called "front-half catch," "solids," or "dry filterable particulates").
3. Same as code method 1 except that sampling is conducted at a point of average velocity.
4. Same as code method 2 except that sampling is conducted at a point of average velocity.
5. Isokinetic sampling at point of average velocity with impingers (two containing distilled water, one dry) followed by Whatman* paper thimble. Gas-meter upstream of pump. Result includes material collected on the filter and in the impingers (soluble and insoluble) except sulfuric acid bihydrate.
6. Alundum thimble packed with glass wool followed by a Gelman type A filter. Both thimble and filter inside stack during test.
7. San Francisco Bay Area Air Pollution Control District Regulation 2 method—Particulate collected by glass tubes filled with wool located in stack. Gas velocity predetermined by separate pitot tube and assumed constant throughout test. Samples collected at two to three of the points of measured velocity during each test.

*Mention of commercial products or company names does not constitute endorsement by the Environmental Protection Agency.

8. EPA equipment, including impingers, is used, but probe and impinger acetone washings are combined. Results include washings and filter catch and are therefore higher than those of code method 2 (filter catch and probe washings only).
9. Adjusted EPA train with impinger results—Data obtained using code method 1 was adjusted by multiplying it by the average value of the ratio of code method 2 to code method 1 for two secondary lead blast furnaces.
10. Alundum thimble in stack, packed with glass wool and followed by impingers. Impinger liquid is filtered and filtrate is included as particulate. Probe is washed and material in washings is included as particulate.
11. Nondirect infrared test for carbon monoxide—Will appear in the *Federal Register* as Method 10—Determination of Carbon Monoxide Emissions from Stationary Sources.
12. Cadmium salt test for hydrogen sulfide—Will appear in the *Federal Register* as Method 11—Determination of Hydrogen Sulfide Emissions from Stationary Sources.
13. Samples evacuated by air ejector through an in-stack alundum thimble and four impingers (two containing distilled water). Result consists of material from filter and soluble and insoluble material collected in impingers.
14. Samples using impingers followed by a Gelman type A glass fiber filter. Result includes filter and impinger catches.

Control Equipment

Listed below are symbols used in the background document for various types of control devices. If more than one are used, the order of the letters indicates the arrangement of the control devices, starting with the one farthest upstream.

- s — scrubber
- v — venturi scrubber
- b — baghouse
- e — electrostatic precipitator
- a — afterburner
- h — open hood
- g — closed hood
- c — cyclone
- m — carbon monoxide boiler
- p — plate scrubber

TECHNICAL REPORT NO. 6 - ASPHALT CONCRETE PLANTS

SUMMARY OF PROPOSED STANDARDS

Standards of performance are being proposed for new hot mix asphalt concrete production plants. The proposed standards would limit emissions of particulates (including visible emissions) from the following sources: dryer; hot aggregate elevators; screening (classifying) equipment; hot aggregate storage equipment; hot aggregate weighing equipment; asphalt concrete mixing equipment; mineral filler loading, transfer, and storage equipment; and loading, transfer, and storage equipment that handles the dust collected by the emission control system.

The standards apply at the point(s) where undiluted gases are discharged from the air pollution control system or from the affected facility if no air pollution control system is utilized. If air or other dilution gases are added prior to the measurement point(s), the owner or operator must provide a means of accurately determining the amount of dilution and correcting the pollutant concentration to the undiluted basis.

The proposed standards would limit particulate emissions to the atmosphere as follows:

1. No more than 70 mg/Nm^3 (undiluted) or 0.03 gr/dscf .
2. No more than 10 percent opacity.

EMISSIONS FROM ASPHALT CONCRETE PLANTS

The asphalt concrete industry has been generally recognized as a major source of particulate emissions. Poorly controlled asphalt concrete plants (Figure 1) can release 10 to 15 pounds of

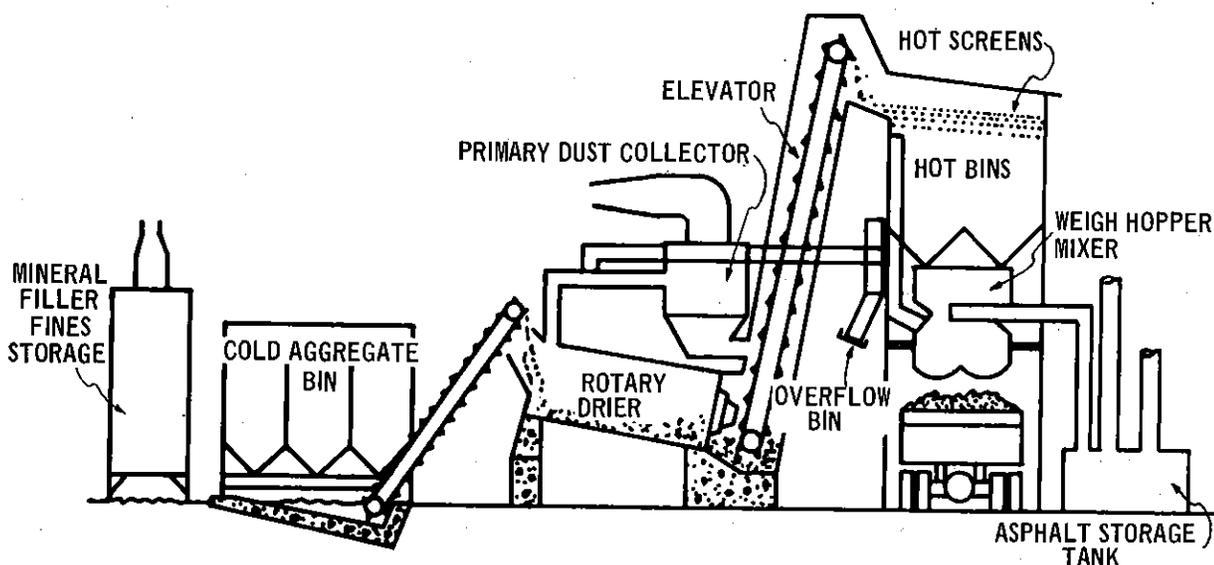


Figure 1. Uncontrolled hot-mix asphalt concrete plant.

particulates to the atmosphere per ton of asphalt concrete product.¹ A 200-ton/hr installation, equipped with only dry centrifugal dust collectors, would emit 2000 to 3000 pounds of particulate each hour of operation. Because of the large number of plants (approximately 4800), their collective emissions constitute a significant portion of the total particulate from all industries. EPA has conservatively estimated that total particulate emissions from this industry were 243,000 tons in 1967 and would increase to 403,000 tons in 1977 if the 1967 control level of 95 percent were maintained.² According to A.E. Vandergrift, et al., the asphalt industry is the eleventh largest source of particulate emissions in the nation.³

In order to reduce emissions by about 99.7 percent, as required by the proposed standard, fabric filters or medium energy venturi scrubbers, normally preceded by a cyclone or multiple cyclone, are used to collect dust from the dryer (Figure 2). Fugitive dust from the hot aggregate conveyor,

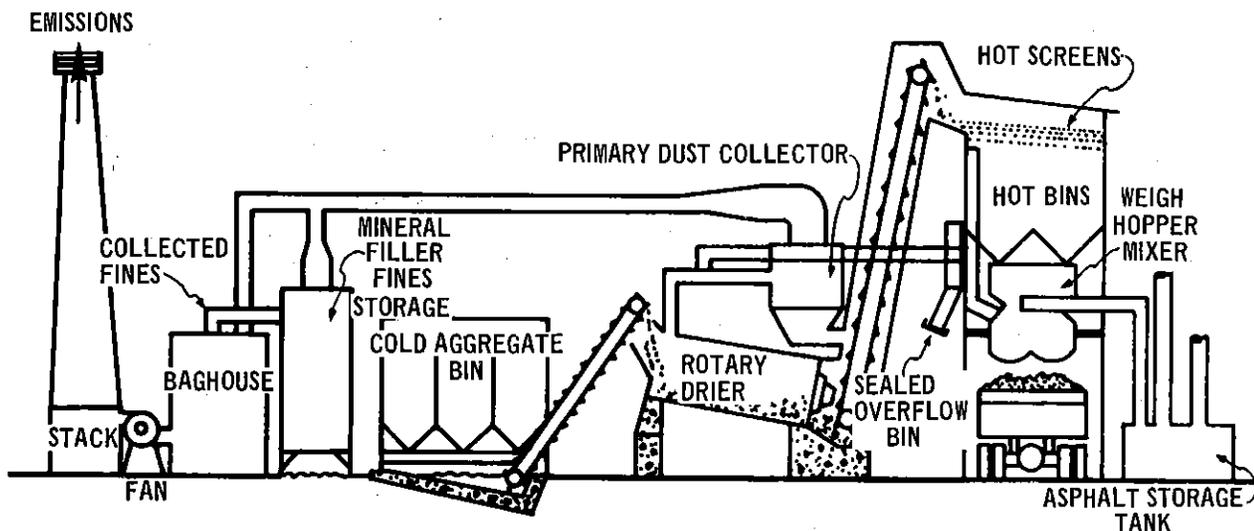


Figure 2. Controlled hot-mix asphalt concrete plant.

screening, mixing, and other process equipment is normally controlled by enclosing these sources and ducting the dust-laden gases to the dust collection system. The collected dust is normally recycled to the plant, thereby increasing product yield.

Most State and local regulations limit particulate emissions from asphalt concrete plants, either on the basis of stack gas concentration or through process weight regulations. The most stringent State regulation, 0.03 gr/dscf (based on samples collected with both the filter and impingers), would permit the typical 200-ton/hr plant to emit 5.1 lb/hr of particulate. The reference process weight regulation (Table 1) would restrict emissions from this typical asphalt plant to 40 lb/hr, which is approximately 0.23 gr/dscf.

RATIONALE FOR PROPOSED STANDARDS

The proposed standard of 70 mg/Nm³ (0.031 dscf) is based on 11 tests of plant emissions performed by EPA on four asphalt concrete plants. Three of these plants were controlled with fabric filters, which ranged from 1 to 4 years in age, and one was controlled by a venturi scrubber. Other data that support the level of the standard were obtained from tests conducted by State and local agencies and the National Asphalt Pavement Association. The size of plants tested ranged from 80 to 350 tons/hr. Preliminary investigations by EPA revealed the location of several reportedly well controlled plants. Sixty-four were visited, visible emissions were evaluated, and information was obtained on the process and control equipment. Fifty-two were determined

unsatisfactory because of inadequate maintenance or design, often evidenced by excessive visible emissions, or because the equipment was not suitable for testing (e.g., a pressure-type baghouse without a stack). Eight of the remaining 12 plants were eliminated because of planned shutdowns for the winter season. Stack tests were conducted at four locations.

During the initial plant surveys, 12 plants with fabric filter control equipment exhibited no visible stack emissions other than uncombined water vapor. Nine of these plants were not tested for reasons listed above.

Results of the four tests (three samples per test) conducted by EPA (Figure 3) reveal that emissions from the three plants with fabric filter controls (Plants A, B, and D) averaged 0.007,

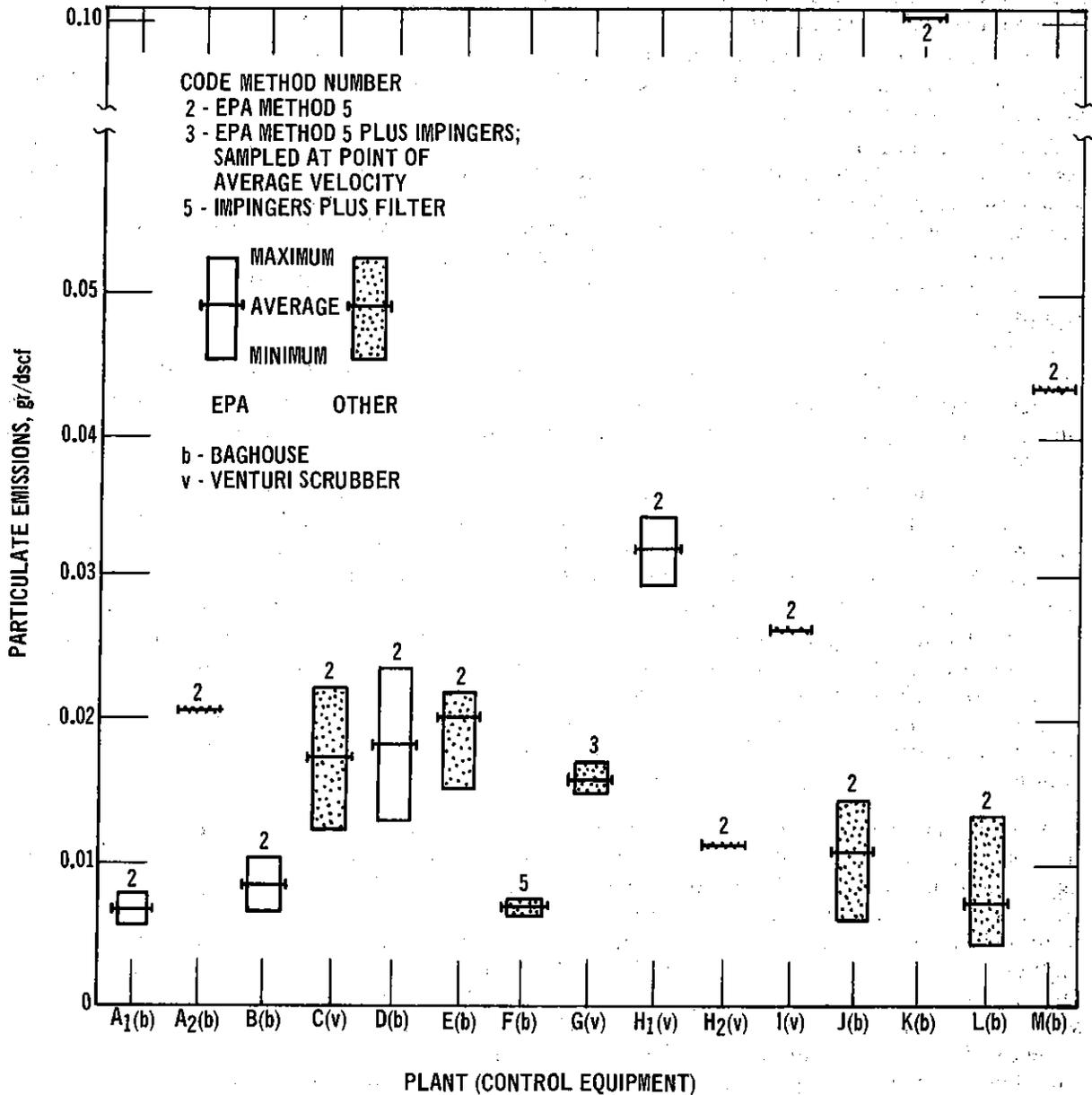


Figure 3. Particulate emissions from asphalt concrete plants, combined dryer and scavenger exhausts.

0.008, and 0.018 gr/dscf. Individual sample results ranged from 0.005 to 0.024 gr/dscf. The plant controlled by a venturi scrubber (Plant H₁) emitted 0.031 gr/dscf, with individual tests ranging from 0.029 to 0.034 gr/dscf. The same plant while operating at a higher scrubber energy consumption, was retested by a State agency (Plant H₂), and emissions were 0.011 gr/dscf.

Included in Figure 3 are State and local agency test data, which also support the proposed standard. Three of the plants tested were controlled by venturi scrubbers (Plants C, G, and I) and three by fabric filters (Plants E, F, and J). Measured emission rates from the three scrubber installations ranged from 0.012 to 0.025 gr/dscf and averaged 0.017, 0.015, and 0.025 gr/dscf. Emissions from the three baghouse installations averaged 0.006, 0.010, and 0.019 gr/dscf with individual tests ranging from 0.005 to 0.023 gr/dscf. Four of these tests were performed in accordance with EPA test procedures. The others, although performed with the basic EPA train, incorporated minor modifications.

A manufacturer of control equipment measured emissions for a prototype baghouse collector installed at an actual asphalt plant for continuing pilot tests. Results of these 0.012 gr/dscf tests, are well below the standard.

Additional support for the standard has been provided by the National Asphalt Pavement Association from tests of four asphalt concrete plants (Plants A₂, K, L, and M). The four plants, which used fabric filter collectors, had average emissions of 0.007, 0.012, 0.043, and 0.108 gr/dscf. The two latter values are not considered representative of good maintenance and operation. In both cases, the dust collectors were inspected by an EPA engineer or by the manufacturer prior to the test.⁴ Evidence of poor collector maintenance or operation made the efficiency of the control equipment suspect.⁵

Letters on file from three manufacturers of fabric filter collectors and one manufacturer of venturi scrubbers guarantee emission levels to meet a standard of 0.030 gr/dscf if equipment is properly installed, operated, and maintained. At least two other manufacturers (one of fabric filters and one of venturi scrubbers) are guaranteeing an emission level to meet 0.030-gr/dscf State and local codes.

Two of the three fabric filter installations tested by EPA had recently substituted fuel oil for the natural gas normally fired in the dryer burner (Plants A and B). The third was burning natural gas. The replacement of natural gas with fuel oil has been reported to increase particulate mass emission by 20 to 30 percent.¹ Consequently, the emissions measured for the plants using oil for fuel would probably have been smaller if the tests had been conducted before the change in fuels.

All EPA tests were performed in the fall, near the end of the asphalt production season, when the plant is most likely to be in poor repair. The winter months are utilized for maintenance. Thus, the control devices were tested immediately prior to the annual maintenance cycle. Of the three fabric filter collectors tested, two had been in service for one season and one for four seasons without changing the bags. Obviously the control devices were not operating under optimum conditions; i.e., the filters were not new.

A factor that can affect control equipment performance is the particle size of dust released from these systems. Since asphalt concrete plants are installed throughout the nation, a wide variety of aggregate is processed in dryers. In developing the standard, it was necessary to determine the characteristics of these aggregates and to ascertain that available dust collectors could meet the proposed emission limits. Particle size has a significantly greater effect on the performance of high-energy scrubbers than on fabric filters. Particulate emissions from high-energy scrubbers tend to increase with decreasing particle size.^{1, 5-9} Where there are large fractions of fines, scrubbers may require greater energy input. On the other hand, the performance of fabric filter collectors is relatively unaffected by the size distribution of particulates, such that emission levels from baghouses are nearly the same over a wide variety of aggregate feedstocks.⁸⁻¹³ This is further evidenced by the test report of a laboratory study sponsored by the National Asphalt Pavement Association, in which it is concluded that there is no correlation between particle size and the capture efficiency of a fabric filter.⁵

There is no evidence that rapid changes in the amount of fine material and transient conditions during startup and shutdown increase emissions from a fabric filter collector and preclude plants from achieving the proposed standard. The National Asphalt Pavement Association-supported laboratory test,⁵ which did not duplicate actual operating conditions, was partly devoted to studying the effect on collection efficiency of sudden changes in the airflow through a filter without appreciable cake. It was found that when asphalt concrete aggregate was used as the test particulate, exit concentration varied only from 0.00054 to 0.00012 gr/dscf, a factor of only 4.5:1. If, in fact, transient conditions during startup and shutdown did affect fabric filter collection efficiency, such an effect would not preclude plants from achieving the proposed standard. Performance tests do not begin until the effluent gas temperature stabilizes after plant startup, and tests are terminated at plant shutdown. Furthermore, Section 60.8 of 40 CFR Part 60, which specifies that performance tests be conducted during periods of representative performance and consist of three repetitions of the applicable test method, precludes the possibility that performance tests would be unduly influenced by routine shutdowns and startups.

The fines content of the process aggregates is reflected in the fraction of -200-mesh material (less than 74 micrometers). Investigations indicate that 3 to 5 percent of -200-mesh material is typical for aggregates utilized in asphalt concrete plants.^{8,14} To assure that EPA tests were representative, each plant operator was requested to schedule production of a product mix containing a large fraction of -200-mesh materials. During the four tests conducted by EPA, the actual fines content of the aggregate ranged from 2 to 7 percent by weight.

The proposed standard of 0.031 gr/dscf is supported by measured emissions from 13 of the 15 source tests presented in Figure 3. Results from 2 of these 15 source tests cannot be considered representative, since evidence of poor collection, maintenance, and operation made efficiency of the control equipment suspect. The standard will require installation and proper maintenance of equipment representative of the best technology demonstrated (considering cost) for the industry.

ENVIRONMENTAL IMPACT OF PROPOSED STANDARDS

Potential adverse environmental effects from implementing the proposed standard include disposal of collected materials and handling of scrubber liquor to prevent water pollution. At a typical 200-ton/hr plant from 1 to 1.5 tons/hr of particulate will be collected in either dry or wet dust collectors. When fabric filters are used, the material is collected dry and can be recycled or disposed of in that form. In many plants, the collected material is recycled to produce asphalt concrete. Settling ponds are used in conjunction with scrubbers to separate entrained solids. Water is recycled, usually in a closed loop, and collected solids are removed from the pond as necessary. These settled solids are essentially rock and sand and can be safely landfilled. If high-sulfur fuel is used to fire the aggregate dryer, the scrubbing water will eventually become acidic and require neutralization to prevent leaching and equipment corrosion. The small quantity of soluble salts that will be produced as a result of the neutralization should not present a problem. Washing techniques are available to minimize soluble salt carryover in collected solids.

ECONOMIC IMPACT OF PROPOSED STANDARDS

The production of asphalt concrete has increased at an annual rate of 10 percent over the past several years. Although growth has been cyclical, it is expected that this average rate will persist through the near future. To meet increase demand, it is anticipated that 200 new plants will be constructed each year. In addition, the industry estimates that some 50 obsolete plants will be replaced annually. Approximately 250 new plants each year are estimated to be subject to a new source performance standard.

For a new asphalt concrete plant rated at 150 tons/hr (average on-stream time of 50 percent, annual production of 112,500 tons) and also for a plant rated at 300 tons/hr (average on-stream time of 50 percent, annual production of 225,000 tons), three abatement alternatives were analyzed. Table 3 summarizes the results of these analyses. The objective of the analyses was to compare the cost effects of two standards: the reference process weight standard and the proposed

Table 3. CONTROL COSTS FOR TYPICAL ASPHALT CONCRETE PLANTS^a

Plant size, tons/hr (acfm)	Emission standard	Required control equipment	Control investment, \$	Annual cost, \$/yr	Annual cost per unit of production, \$/ton
150 (25,000)	Proposed performance standard= 0.031 gr/dscf Reference process weight standard= 0.30 gr/dscf	Fabric filter	63,000	18,000	0.16
		Venturi scrubber	56,000	21,000	0.19
		Low-energy scrubber	44,000	16,000	0.14
300 (50,000)	Proposed performance standard= 0.031 gr/dscf Reference process weight standard= 0.18 gr/dscf	Fabric filter	92,000	26,000	0.12
		Venturi scrubber	95,000	36,000	0.16
		Low-energy scrubber	75,000	27,000	0.12

^aModel plant assumptions: (1) 1500 hours on-stream annually, (2) production averages 50 percent of capacity, (3) 10-year straight-line depreciation, (4) 50 percent of retained fines, valued at \$9/ton, recycled, and (5) average product price of \$6/ton.

new source performance standard. Estimating the cost to achieve the two standards provides a measure not only of the total cost but also the incremental cost of control.

Either the fabric filter or the venturi scrubber will enable a new plant to comply with the proposed standard, and the capital costs for these devices do not appear to be significantly different for either size plant (300 tons/hr or 150 tons/hr). On an annualized cost basis, it appears that the fabric filter is the lesser-cost device for both plant sizes. The key element is that the fabric filter collects the particulate material in a useful form, while the material collected by the scrubber must be disposed of at the operator's expense. An independent study states that in the case of asphalt concrete plants, properly designed, operated, and maintained fabric filter collectors can be a profitable investment and not an add-on cost.¹⁵ This study concluded that, even for a small plant (100 tons/hr), use of fabric filter collectors is more economical than wet collector systems.¹⁵ Thus, it may be assumed that most new plants would favor a fabric filter control system on an economic basis when selecting a control system to comply with the proposed standard.

The installation of a fabric filter on the smaller plant necessitates an increase in capital investment of 24 percent over the base-plant investment. However, the incremental investment required to equip the plant with a fabric filter rather than a low-energy scrubber (to comply with reference process weight curve) is 6 percent. Similarly for the larger plant, the additional capital investment required by the fabric filter over the base-plant investment is 28 percent, while the incremental investment over equipping the plant with a low-energy scrubber is 4 percent.

The incremental investment required by the proposed standard above that required by State standards is not anticipated to create any serious additional financing problems for new asphalt concrete plants.

Since the control cost for a new plant meeting the proposed standard approximates the cost for an existing plant meeting a less stringent standard, the management of new plant should find that the market price is sufficient to recover much, if not all, of the cost of complying with the proposed standard. As a result, there should be little or no reduction in earnings for the new plant.

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TECHNICAL REPORT NO. 7 -

PETROLEUM REFINERIES, FLUID CATALYTIC CRACKING UNITS

SUMMARY OF PROPOSED STANDARDS

Proposed standards of performance for petroleum refineries will limit emissions of particulates (including visible emissions) and carbon monoxide from new or modified catalyst regenerators on fluid catalytic cracking units.

Standards for Particulates

The proposed standards will limit particulate emissions to the atmosphere as follows:

1. No more than 50 mg/Nm³ (undiluted), or 0.022 gr/dscf.
2. No more than 20 percent opacity except for 3 minutes in any 1 hour.

The proposed visible emission standard is compatible with the mass emission limit; if particulate emissions are at or below 50 mg/Nm³, visible emissions will be below 20 percent opacity.

Standard for Carbon Monoxide

The proposed standard will limit carbon monoxide emissions to no more than 0.050 percent by volume, dry basis.

The proposed carbon monoxide standard can be met by incineration. The most common device is an incinerator/waste heat boiler, which is normally fired with refinery fuel gas. In the units tested, only gas was used to supplement the combustion of carbon monoxide. Fuel oil can be used as the auxiliary fuel, but greater concentrations of particulate would be expected. No emissions data are available for well controlled units using fuel oil.

The availability of refinery fuel gas and boiler maintenance considerations minimize the use of fuel oil. For these reasons provisions added to the regulations allow the particulate matter generated by firing fuel oil to be subtracted from the total particulate matter measured by the compliance test method. Owners and operators will be required to meet the visible emission standard regardless of the type of auxiliary fuels burned.

EMISSIONS FROM PETROLEUM REFINERIES

An uncontrolled fluid catalytic cracking unit can release over 300 lb/hr of catalyst dust.³ Such installations are equipped only with internal centrifugal dust collectors, which primarily serve to recycle the catalyst. The proposed standards will require owners and operators of new facilities to reduce the level of particulate emissions about 93 percent below the level of an uncontrolled unit. In addition, an uncontrolled unit can release over 15 pounds of carbon monoxide per barrel of petroleum feedstock processed.⁴ For a unit processing 40,000 barrels per day (bbl/day), about 20 tons/hr of carbon monoxide would be released. The proposed standard will require owners and operators of new facilities to reduce carbon monoxide emissions 99.5 percent below those of an uncontrolled unit.

At many modern petroleum refineries, an electrostatic precipitator is used to control dust from the fluid catalytic cracking unit catalyst regenerator. A waste heat boiler fired with auxiliary fuel is used to control carbon monoxide from the units (see Figures 4 and 5).

The reference process weight regulation (Table 1) is less stringent than the proposed standard for units of a practical size (less than 150,000 bbl/day). The most stringent State or local regulations restrict emissions to 30 lb/hr.

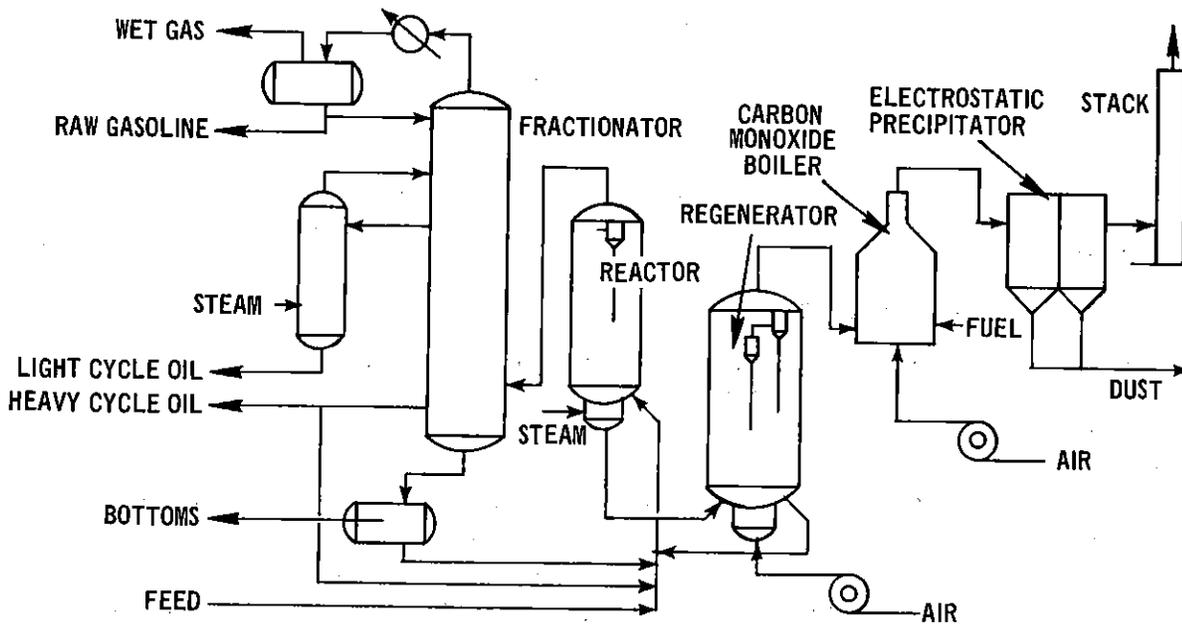


Figure 4. Petroleum refinery fluid catalytic cracking unit with control system.

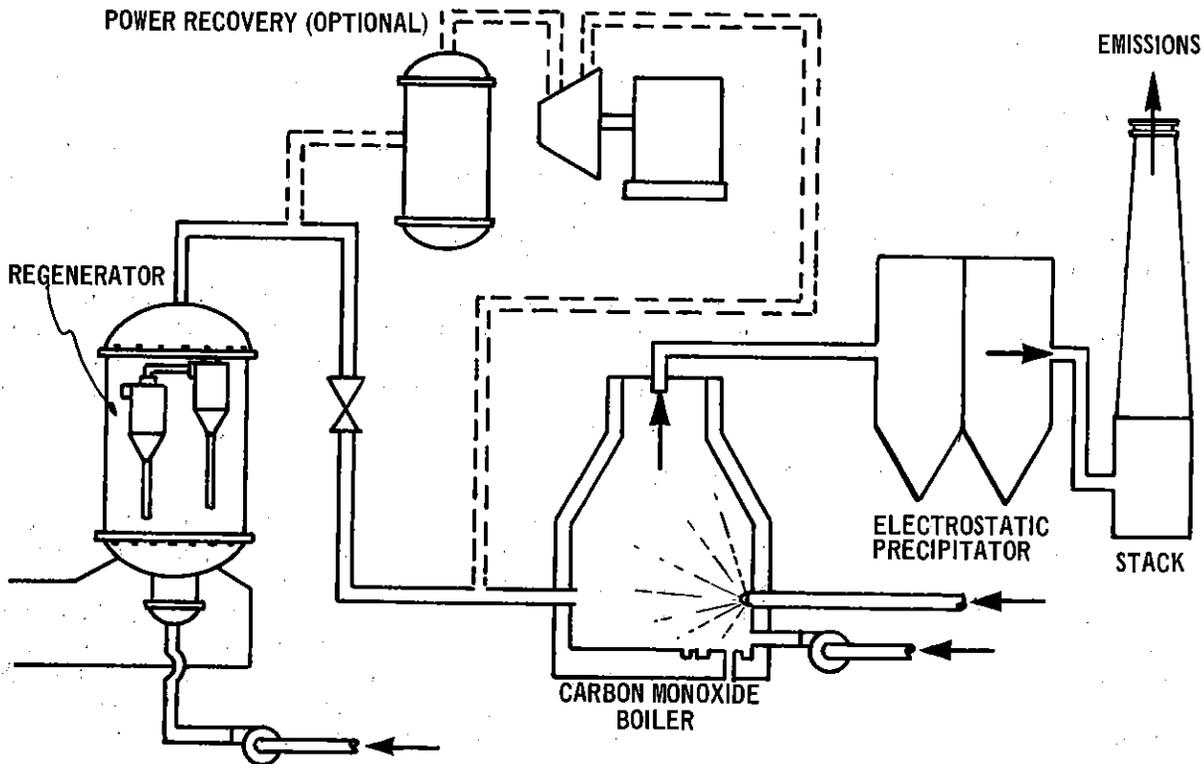


Figure 5. Fluid catalytic cracking unit regenerator with carbon monoxide boiler and electrostatic precipitator.

New units will range in size from 10,000 to 100,000 bbl/day of fresh feed, with gas flow rates varying from 20,000 to 350,000 dscfm, respectively. The proposed standard will allow 3 to 60 pounds of particulates per hour. For a typical unit rated at 50,000 bbl/day of fresh feed at a gas flow rate of 150,000 dscfm, the proposed standard will allow an emissions of 25.7 lb/hr of

particulate matter. The reference process weight regulation will limit emissions to 64 lb/hr based on a catalyst recirculation rate of 50 tons/min.

State or local regulations are comparable with the EPA-proposed standard for carbon monoxide, but are generally framed in different language. Nonfederal standards usually require the combustion of carbon monoxide for 0.3 second at a temperature above 1300°F. The same type of control equipment (carbon monoxide boilers) is required in most cases to meet the proposed standards. For certain types of catalyst regenerators, the boiler may not be required because the carbon monoxide is combusted in the regenerator itself. In either case, the proposed standard requires a 99.5 percent reduction in carbon monoxide emissions over an uncontrolled unit.

RATIONALE FOR PROPOSED STANDARDS

Preliminary investigations revealed the locations of 17 well controlled cracking units in the United States. These plants were visited and information was obtained on the type of refinery process and the control equipment used. Visible emissions at 13 plants were observed to be 20 percent opacity or less. Judgment regarding the feasibility of stack testing was made for each plant. In this regard, 12 locations were unsatisfactory because the control equipment was judged to be less than optimum or the physical layout of the equipment made testing unfeasible. One unit could not be tested because it was undergoing a turnaround. Stack tests were conducted at four locations.

Particulate Matter

The proposed particulate emission limit is based on tests by EPA, local agencies, and plant operators and data on control efficiencies and emission levels achieved at similar stationary sources. The control level required by the standard has been demonstrated on only a few catalyst regenerators. In proposing new standards, much weight has been given to the fact that higher efficiency particulate collectors could be installed at refineries and the fact that such collectors have been installed at both smaller and larger particulate sources, for example, basic oxygen steel furnaces and secondary lead furnaces.

Of the three catalyst regenerators tested by EPA, all of which were controlled by electrostatic precipitators, one showed particulate emissions below the proposed standard (Figure 6). Emissions average 0.014 gr/dscf for three individual runs ranging between 0.011 and 0.016 gr/dscf. This unit was retested by EPA and showed average particulate emissions of 0.022 gr/dscf with three individual runs ranging between 0.020 and 0.023 gr/dscf. Emission data gathered by the refinery over a 7-month period of operation (Figure 6) showed average particulate emission of 0.014 gr/dscf from 14 individual tests ranging between 0.010 and 0.021 gr/dscf. In addition, emission data gathered by a second refinery over a 17-month period of operation (Figure 6) showed average particulate emission of 0.017 gr/dscf from eight individual tests ranging between 0.015 and 0.022 gr/dscf. The refinery test methods were the same in each case. Both refiners employed different filter media than the EPA method, but neither included impingers.

EPA tests of two units controlled by electrostatic precipitators (Figure 6) average 0.037 gr/dscf for each test. Results of a fourth unit were invalid because of a process malfunction during testing. Results of six tests on four fluid catalytic cracking unit regenerators conducted by a local control agency³ are shown in Figure 6. Emissions from all units were controlled by electrostatic precipitators and carbon monoxide waste-heat boilers. Particulate emissions averaged 0.013, 0.017, 0.018, 0.018, and 0.020 gr/dscf, respectively. The test method used is comparable with, although not identical to, the EPA method.

Two control equipment designers have stated that they will guarantee particulate emission levels of about 0.010 gr/dscf. Both of these firms have installed several units on catalyst regenerators.

To determine the level of the proposed standard, further evaluation was made of particulate collector design. Electrostatic precipitators are the only high—efficiency dust collectors that have been used with catalyst regenerators. Many of these precipitators are rated at 90 to 95 percent

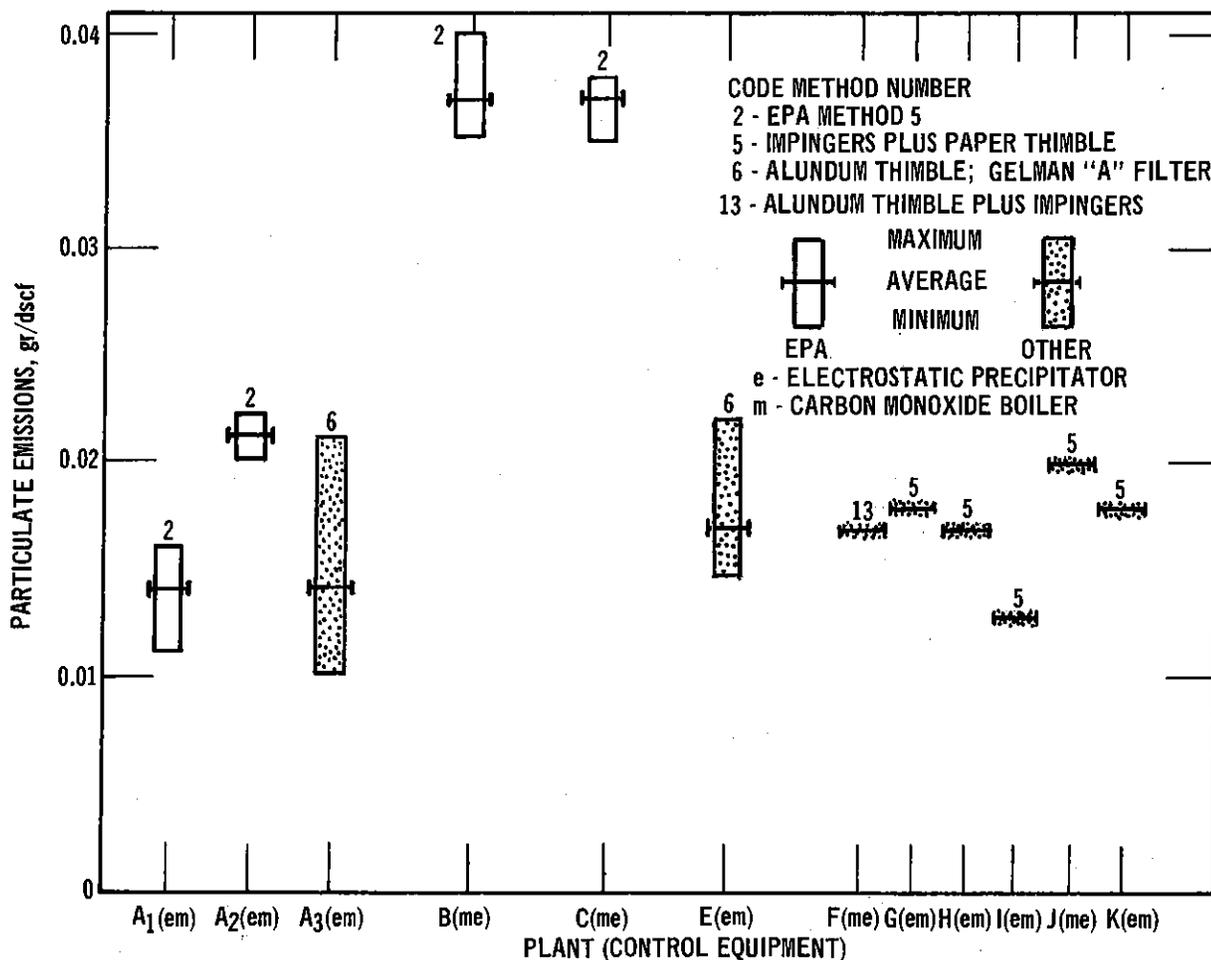


Figure 6. Particulate emissions from petroleum refineries, fluid catalytic cracking units.

efficiency for oil refinery emissions, as compared with the 98 to 99+ percent range encountered in other industries; however, the exit concentrations at refineries are not as low as with some other sources. For instance, an electrostatic precipitator cited in Report No. 12 for iron and steel plants was found to achieve a level of 0.007 gr/scf when applied to a basic oxygen steel furnace. The efficiency of this precipitator was considerably greater because there was a much greater inlet loading to the precipitator than is encountered with catalyst regenerators at oil refineries.

Several parameters affect the performance of an electrostatic precipitator, and it is not within the scope of this document to discuss them all. Other parameters being equal, however, collector efficiency tends to increase with plate area. It is significant that:

1. The electrostatic precipitator that exhibited the lowest exit concentration during the EPA tests has considerably greater plate area (250 ft²/1000 acfm of gases) than the other electrostatic precipitators (175 and 190 ft²/1000 acfm) tested by EPA.
2. The previously mentioned precipitator serving a basic oxygen steel furnace has a plate area of 375 ft²/1000 acfm.
3. Precipitators with collection plate areas from 250 to more than 400 ft²/1000 acfm have been installed at steel furnaces, cement kilns, municipal incinerators, and other sources.

Based on these considerations, it is concluded that exit concentrations of 0.020 gr/dscf can be achieved with electrostatic precipitators of the same general design as, but with greater plate area than, those that have already been installed by refineries. In addition, it will probably be necessary that the precipitators be constructed in modules so that maintenance and repair operations can be

conducted while the unit remains in service. Catalyst regenerators frequently are kept on-stream for 2 years or longer with few shutdowns that would allow time to conduct repairs and maintenance.

Visible emissions of less than 20 percent opacity were observed at all three of the units tested by EPA. Ten additional units were observed by EPA engineers to have visible emission levels that meet the proposed standard. The proposed standard can be exceeded for 3 minutes in any 1 hour to allow the blowing of soot from the tubes of the carbon monoxide waste-heat boiler.

Carbon Monoxide

In addition to particulate matter, carbon monoxide concentrations were determined during the EPA tests of well controlled cracking units. The four units, each controlled by a carbon monoxide incinerator/waste heat boiler, showed carbon monoxide emissions well below the proposed standard (Figure 7). Carbon monoxide emissions from three tests on two units averaged 5, 10, and 25 ppm (25 ppm is 0.0025 percent by volume). No measurable carbon monoxide emissions occurred at the two remaining units tested.

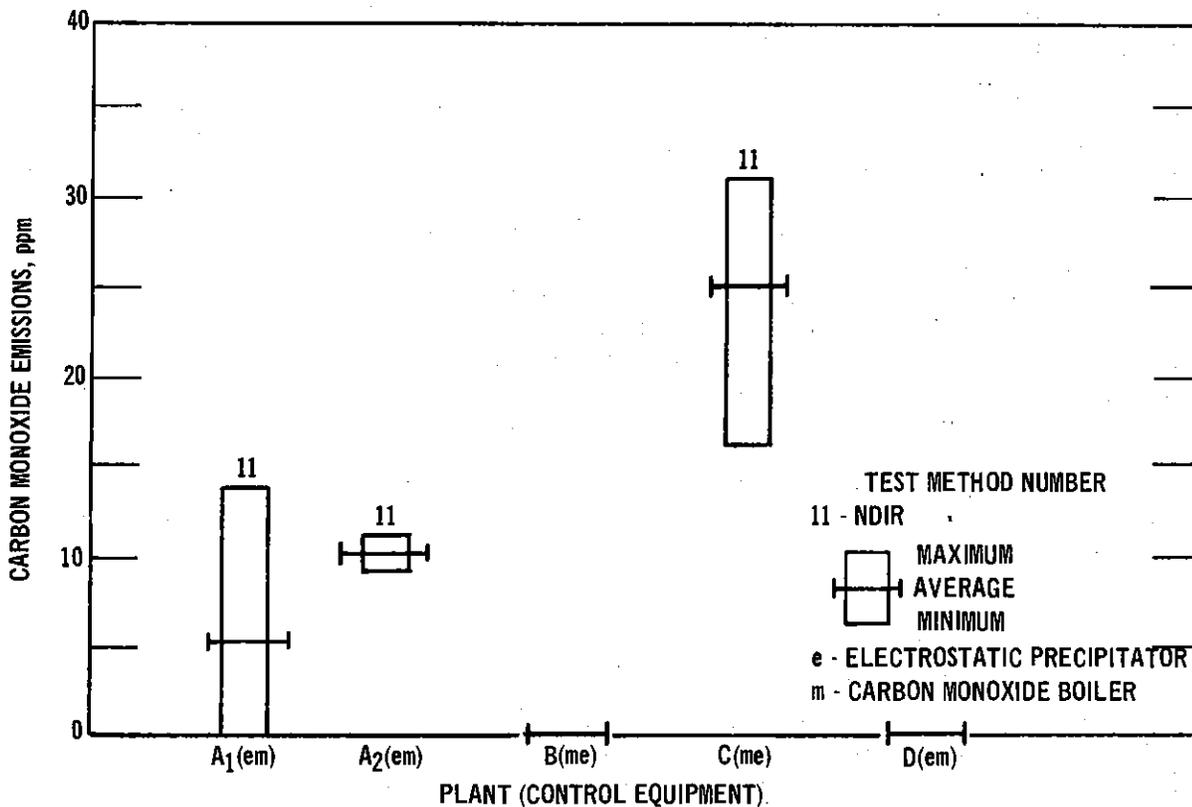


Figure 7. Carbon monoxide emissions from petroleum refineries, fluid catalytic cracking units.

The proposed carbon monoxide standard will require the use of either an incinerator/waste heat boiler or a regenerator that is capable of the almost complete burning of carbon and carbon monoxide to carbon dioxide. Burning carbon monoxide in the regenerator (in situ)⁴ is a relatively recent innovation that was developed along with improvements in catalytic cracking technology, which significantly increase the yield of gasoline. In recognition of the more effective use of natural resources, the standard is being proposed at a level that can be achieved with in situ combustion even though incinerator/waste heat boilers would provide greater reductions in carbon monoxide emissions.

ENVIRONMENTAL IMPACT OF PROPOSED STANDARDS

The disposal of collected catalyst dust presents a potential adverse environmental effect, as would the disposal of scrubber liquor if scrubbers were utilized with fluid catalytic cracking units. Nevertheless, it is expected that electrostatic precipitators will continue to be the principal collection device used in the near future.

Crystalline zeolite (molecular sieve) catalysts are now in predominant use in the industry. The bulk of collected particulates is catalyst dust caused by attrition. It has little catalytic cracking value and is seldom returned to the cracking system. Collected particulates include zeolites, unburned carbon, trace metals, sulfur compounds, silicates, and alumina, none of which have appreciable solubility. The usual method of disposal is by landfill.

ECONOMIC IMPACT OF PROPOSED STANDARDS

The growth in catalytic cracking capacity is estimated to be about 685,000 bbl/day of fresh feed over the next 5-year period. Currently, about 80 percent of existing capacity is operated by "major" petroleum refiners and 20 percent is operated by "independent" petroleum refiners. The trend in new refinery construction is to install processing units of increased capacity. For the purposes of this analysis, it is assumed that about 80 percent of new capacity will be from construction of large (65,000 bbl/day of fresh feed) units by the major refiners and the remaining 20 percent from construction of small units (20,000 bbl/day of fresh feed) by the independent refiners. Over the next 5 years, then, it is estimated that nine large units and six small units will be constructed, or about two large units and one small unit annually.

The costs required to meet the proposed emission standards are proportionately less on larger sized units. The investment costs for a carbon monoxide boiler and an electrostatic precipitator installed on a 65,000-bbl/day fresh-feed unit and on a 20,000-bbl/day fresh-feed unit range from about 25 to 36 percent of the basic process equipment investment cost, respectively. This cost is not all unproductive investment, however. The cost savings generated from steam production in the carbon monoxide boiler more than offset the annual cost of the electrostatic precipitator and carbon monoxide boiler. The value of the stream to the refiner depends on his alternate fuel cost; and, because the price of natural gas and other fuels is likely to keep rising, the value of the stream produced will increase in the future. The carbon monoxide boiler investment costs and annual savings are:

Unit size	Investment	Annual savings
20,000 bbl/day	\$1,800,000	\$235,000
65,000 bbl/day	\$3,000,000	\$1,250,000

Because the carbon monoxide boiler has an attractive economic payout, most new units would be built with carbon monoxide boilers even without the requirements of the proposed standards. The increase in process unit investment that is necessary to install an electrostatic precipitator on a 65,000-bbl/day unit and a 20,000-bbl/day unit, with the carbon monoxide boiler investment cost included as basic process equipment cost, ranges from about 6 to 8 percent. The increase in annual operating cost ranges from about 6.2 to 9 percent.

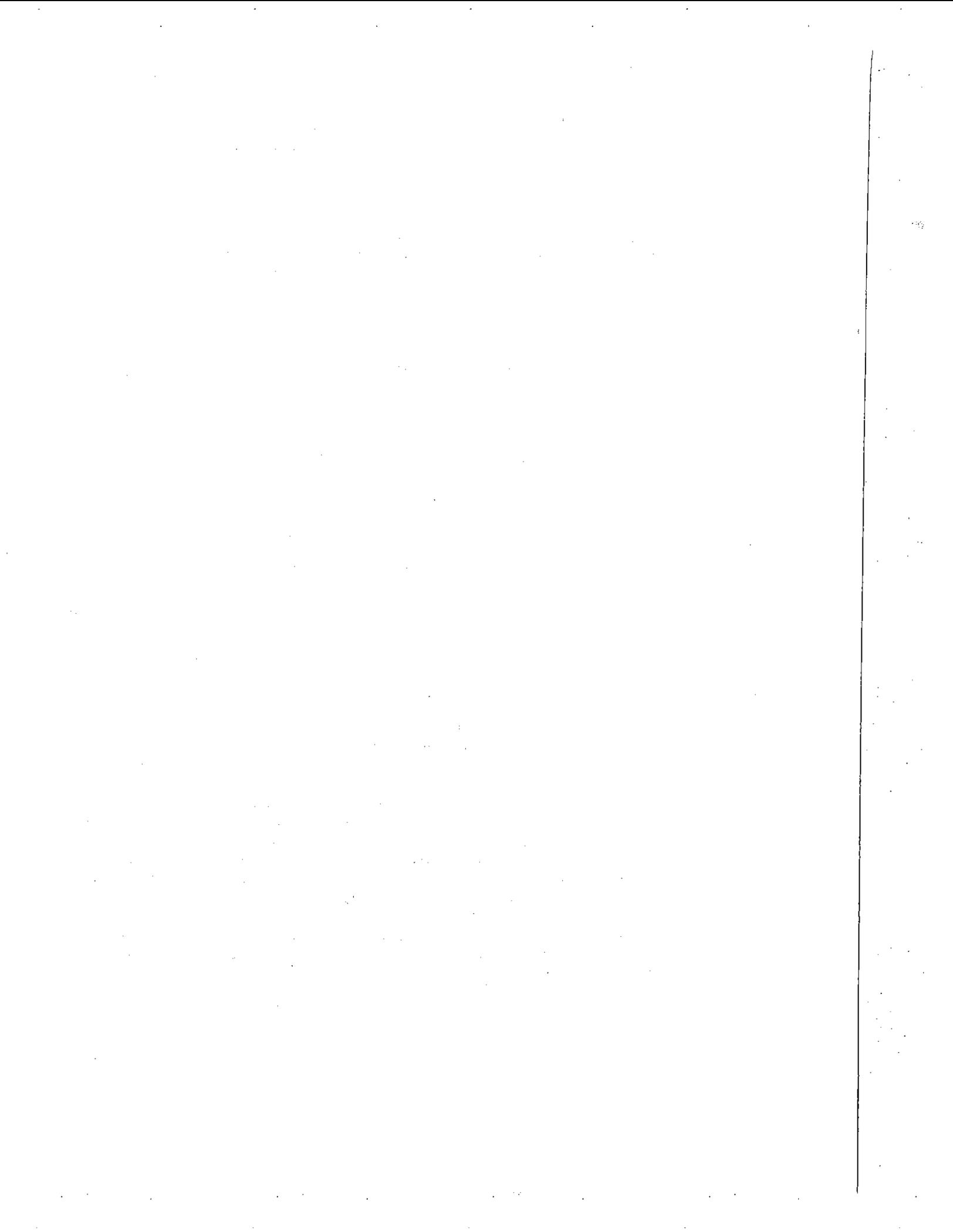
The investment and annualized costs required to meet the new source performance standard and the reference process weight regulation are shown in Table 4. These costs are based on the use of electrostatic precipitators as the particulate control device. The basic units were assumed to have two-stage internal cyclones.

**Table 4. CONTROL COSTS FOR CATALYTIC CRACKING UNITS
EQUIPPED WITH ELECTROSTATIC PRECIPITATORS**

Plant size, bbl/day	Emission standard	Control investment, \$	Annual cost, \$/yr	Annual cost per unit of throughput, ¢/bbl
20,000	Proposed performance standard 0.022 gr/dscf	700,000	150,000	2.2
	Reference process weight standard equivalent to 0.09 gr/dscf	470,000	110,000	1.6
65,000	Proposed performance standard 0.022 gr/dscf	1,150,000	225,000	1.0
	Reference process weight standard equivalent to 0.035 gr/dscf	1,050,000	205,000	0.9

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TECHNICAL REPORT NO. 8 - PETROLEUM REFINERIES, BURNING OF GASEOUS FUELS

SUMMARY OF PROPOSED STANDARD

The proposed standard of performance for petroleum refineries will limit emissions of sulfur dioxide from process heaters, boilers, and waste gas disposal systems that burn process gas generated in the refinery. The proposed standard does not apply to extraordinary situations, such as emergency gas releases, or to the burning of liquid or solid fuels in the same heaters and boilers.

The proposed standard will limit sulfur dioxide emissions to the atmosphere from heaters, boilers, and flares by specifying that the fuel gas burned shall contain no more than 230 mg/Nm³ of hydrogen sulfide, or 0.10 gr/dscf, unless resultant combustion gases are treated in a manner equally effective in preventing the release of sulfur dioxide to the atmosphere.

Compliance with the standard is based upon measurement of the hydrogen sulfide concentration in the fuel gas or the sulfur dioxide concentration in the exit gases. The proposed standard is equivalent to a sulfur dioxide content of approximately 20 gr/100 scf of fuel gas burned. Burning such fuel will result in a concentration of 15 to 20 ppm of sulfur dioxide in the combustion products.

The regulation would have the effect of requiring hydrogen sulfide removal from all refinery-generated fuel gases used to fire new boilers and heaters. The extracted sulfur compounds cannot be burned in flares, heaters, or any other sources unless the control devices used (for example, flue gas scrubbers) are equally effective as fuel desulfurization.

EMISSIONS FROM PETROLEUM REFINERIES

Refinery processes, such as distillation and fluid catalytic cracking, produce substantial quantities of "process gas" (Figure 8) that may contain more than 5 percent hydrogen sulfide by volume. If this untreated gas is burned in heaters, boilers, or flares, substantial quantities of sulfur dioxide will be emitted to the atmosphere. Monoethanolamine (MEA) and diethanolamine (DEA) scrubbing units (Figure 9) are widely used to remove the hydrogen sulfide from both refinery process gases and natural gas.¹ In addition, new processes that employ other scrubbing media are being applied to refinery process gases. The proposed standard will require owners and operators of new facilities to reduce the hydrogen sulfide content of refinery-derived fuel gases to levels that are consistent with these technologies. For most such gases, the proposed limit represents a reduction of more than 99 percent in sulfide levels. For a fuel gas equivalent to methane, the resultant emission of 16 ppm sulfur dioxide is roughly equivalent to the burning of fuel oil containing 0.04 percent sulfur by weight.

Approximately 1 million tons of sulfur charged to U.S. refineries could not be accounted for in 1970. The majority of this sulfur was probably burned and emitted to the atmosphere as sulfur dioxide. If all sources were controlled to the level of the standard, these emissions would be reduced by 95 percent. (Most of the difference between the 99+ percent mentioned in the preceding paragraph and 95 percent is the result of losses in conversion of the recovered gases into sulfur or sulfuric acid.)

At the present time, only one local regulation restricts sulfur dioxide emissions from the burning of refinery process gas. Some State and local agencies have proposed regulations with limits ranging from 10 to 50 grains of hydrogen sulfide per 100 scf of fuel gas burned (19 to 94 grains of sulfur dioxide per 100 scf).

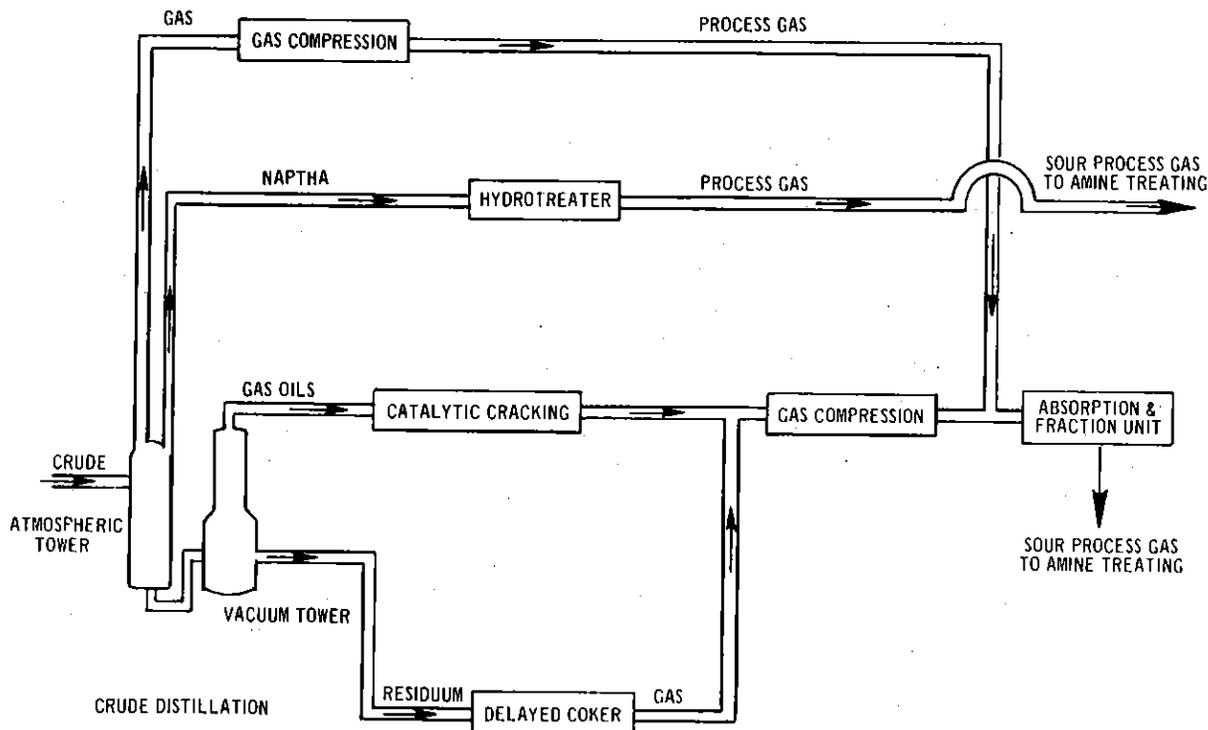


Figure 8. Petroleum refinery process gas system.

RATIONALE FOR PROPOSED STANDARD

The proposed sulfur dioxide standard is consistent with the capability of a well designed and properly operated amine treating unit that is used to scrub typical refinery process gases at the moderate pressures available in the refinery.²⁻⁴ Amine treating technology is well demonstrated and has been widely used to reduce hydrogen sulfide concentrations in gas streams to levels less than that required to meet the proposed standard.

Three refineries were visited by EPA representatives, and information was obtained on the operation of amine systems. All systems were stated to be operating with exit gas concentrations of less than 13 grains of hydrogen sulfide per 100 scf. Diethanolamine (DEA) and monoethanolamine (MEA) scrubbers are found in almost every U.S. refinery, and hundreds are operated in natural gas fields throughout the country. Amine treating is used to reduce the hydrogen sulfide content of natural gas to the pipeline specification level of 0.25 gr/100 scf. It would be difficult, however, to consistently achieve this level in a refinery where treating pressures are lower than in natural gas

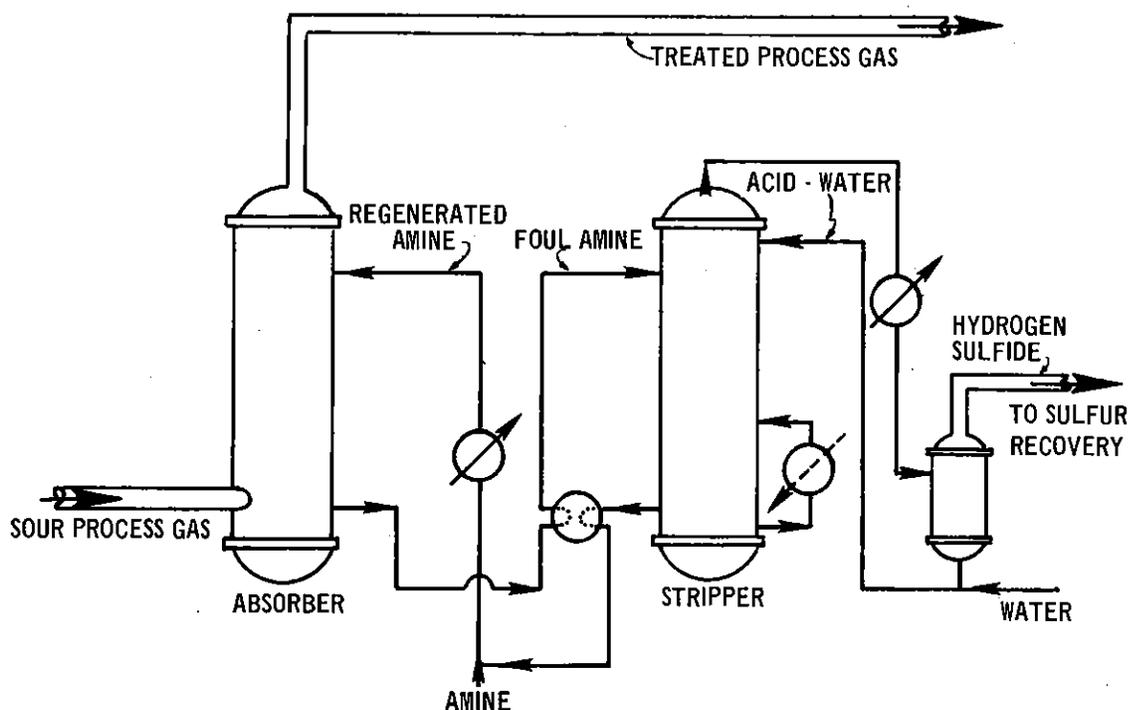


Figure 9. Petroleum refinery process gas treating unit.

fields, since higher treating pressures favor hydrogen sulfide removal. The refinery gases also contain unsaturated hydrocarbons not usually found in natural gas. These unsaturates tend to accelerate fouling of the amine solutions and to reduce scrubbing efficiency. There is no discernible difference in plant hardware or design operating parameters for an amine treating unit designed to treat refinery process gas to 10, 50, or 100 grains of hydrogen sulfide per 100 scf.²⁻⁴ Exit gas levels are apparently associated with operating practices; a standard equivalent to 13 grains of hydrogen sulfide per 100 scf requires good operating practice and has, therefore, been chosen as the basis for the standard.

The proposed standard is expressed in terms of hydrogen sulfide, but can be measured as either hydrogen sulfide in the fuel gas or total sulfur compounds in stack gases. Process gas streams also contain small amounts of other sulfur compounds, which are not removed by the amine scrubbing system. These materials would be included in the total sulfur compounds measured.

ENVIRONMENTAL IMPACT OF PROPOSED STANDARD

Due to thermal and chemical degradation, amine solutions require periodic replacement or treatment. In MEA treating systems, it is common practice to send a continuous slipstream of amine solution to a heated reclaimer. There, caustic soda is added and MEA is disassociated from complex salts, distilled, and returned to the regenerator tower. As the salt content in the reclaimer increases, it is necessary to purge the salts and recharge the reclaimer. For a typical 200,000-bbl/day refinery producing 30×10^6 dscf of process gas, about 2000 lb/month of waste salts may be formed. Water is added to reduce the viscosity of salt slurry before disposal by incineration or landfill.

Diethanolamine has a higher boiling point than MEA and cannot be similarly treated. Usual practice is to continue operating until the solution is spent and the hydrogen sulfide content of treated gas reaches undesirable levels. The entire solution is then replaced with fresh solution. In the typical refinery cited above, approximately 50,000 gallons of solution containing 20 percent DEA and 10 percent complex salts would have to be removed annually.

ECONOMIC IMPACT OF PROPOSED STANDARD

Treatment of the various refinery gas and liquid streams to control product quality is a commonly accepted and necessary practice. Consultation with several engineering companies that design amine absorption systems, which are the most commonly used control devices, indicates that there could be a 2 to 5 percent increase in investment cost, but no discernable difference in operating costs, between a new plant designed to meet the equivalent of 13 grains of hydrogen sulfide per 100 scf and a new one designed to meet 100 grains of hydrogen sulfide per 100 scf (typical current practice). Therefore, there is a small increase in amine treating cost to refiners as a result of the proposed standard. In addition, increased operator effort and attention may be required to maintain the design efficiency of the process during actual operation. Because this cost factor is quite variable depending on the individual company's present operating practice and should be of minor consequence, it has not been quantified. If the refiner chooses to run an increased volume of gas through an existing amine absorption system, he may incur costs in upgrading the existing system to meet the proposed standard. Because each system must be examined individually to determine the cost of upgrading, no attempt has been made to give costs for this type of modification.

It is the intent of the proposed standard that hydrogen-sulfide-rich gases exiting the amine regenerator be directed to an appropriate recovery facility, such as a Claus sulfur plant. A medium-size refinery that processes crude oil containing 0.92 weight percent sulfur, the national average in 1968, would have an emission potential of over 100 tons/day of sulfur dioxide (50 tons/day of sulfur) from the amine regenerator. The annualized cost was calculated for a range of Claus plant sizes. A discontinuity occurs in the cost-capacity curve at about 10 long tons/day. The reason for the discontinuity is that for plants up to about 10 long tons/day, less costly prefabricated package units can be used. Units producing more than 10 long tons/day are generally field-erected and considerably more expensive.

For each size unit, the required sulfur sales price to break even was calculated. At a sales price of \$20/long ton, the break-even size for package Claus units is about 5 long tons/day. The plant investment for a 5-long-ton/day package Claus unit is about \$90,000 exclusive of possible future investment for control of the sulfur dioxide in the tail gas. The break-even size (at a sulfur price of \$20/long ton) for field-erected Claus units is about 15 long tons/day, which represents an investment of about \$350,000.

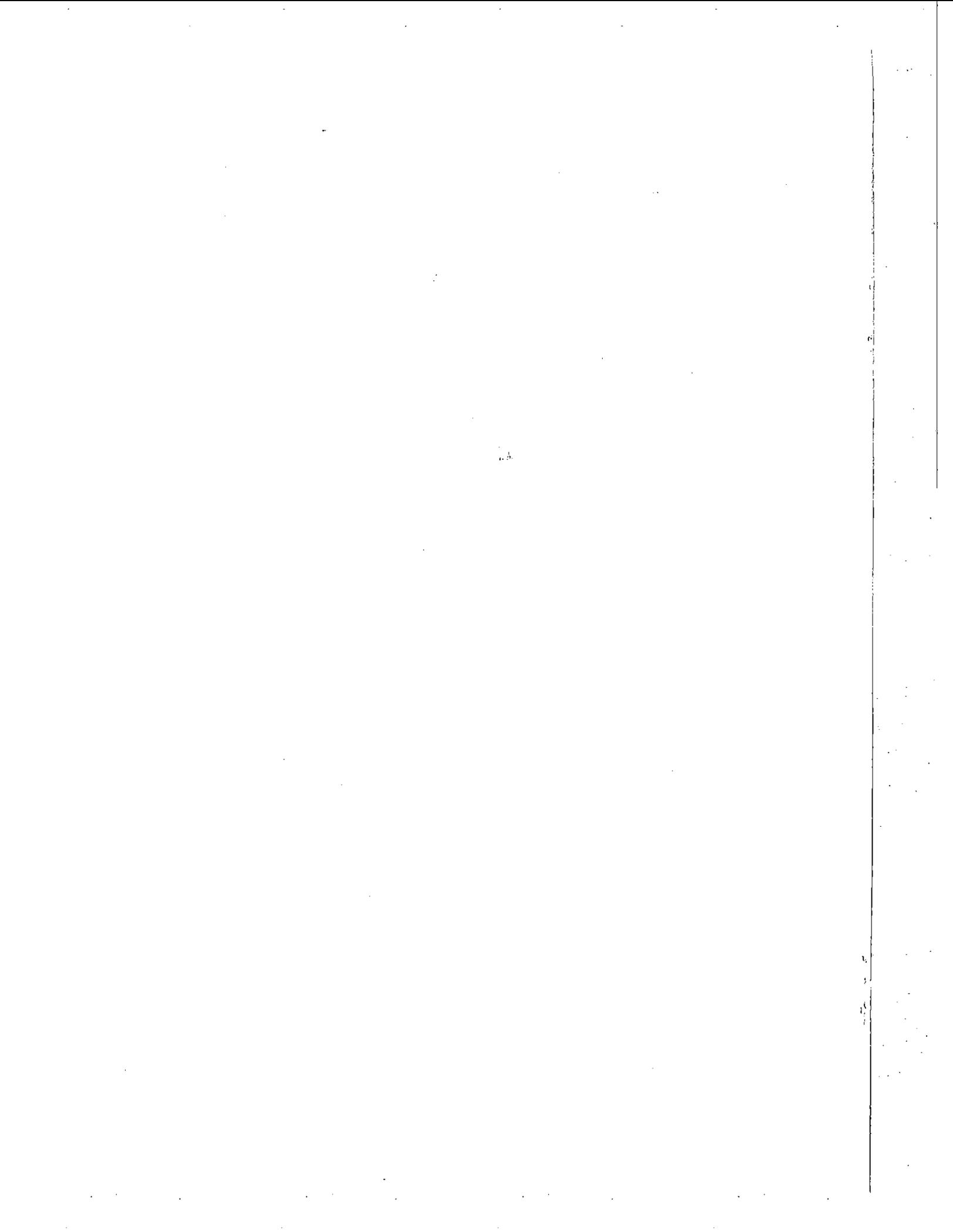
No data are presented to show the cost that refineries would incur if their hydrogen sulfide removal systems were required to meet the 0.25 gr/100 scf achieved by plants processing natural gas. There are several reasons why one should not compare natural gas processing plants with refinery fuel gas systems. The natural gas plant processes gas at a high pressure, with a stable gas composition, and with low levels of impurities. These conditions allow better hydrogen sulfide absorption. Refinery gas is at lower pressure, has a variable composition, and has a variety of impurities that reduce the ability of an absorption system to reach the low levels of hydrogen sulfide achieved in a natural gas plant. The refinery gas pressure could be increased at a high cost, but other limitations would still prevent the absorption system from achieving the low levels found in natural gas plants.

Cost data have not been developed for higher pressure absorption systems, but the small incremental reduction in hydrogen sulfide would make such a system highly questionable from a cost-effective point of view.

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TECHNICAL REPORT NO. 9 - STORAGE VESSELS FOR PETROLEUM LIQUIDS

SUMMARY OF PROPOSED STANDARDS

Standards of performance are being proposed for new storage vessels that have capacities greater than 245,000 liters, or 65,000 gallons, and that are used for the storage of gasoline, crude oil, or petroleum distillates.

The proposed standards will limit hydrocarbon emissions from any storage vessel that contains any petroleum product having a true vapor pressure, at actual storage conditions, as follows:

1. No more than 78 mm Hg, or 1.52 psia: the storage vessel must be equipped with a conservation vent or equivalent.
2. More than 78 mm Hg but not more than 570 mm Hg, or 11.1 psia: the vessel must be equipped with a floating roof or equivalent.
3. More than 570 mm Hg: the vessel must be equipped with a vapor recovery system or equivalent.

In contrast to other new source performance standards, the standards for storage vessels are not proposed in terms of allowable hydrocarbon emissions. Nevertheless, the standards do limit emissions to specific levels, and hydrocarbon release rates can be calculated from empirical relationships developed for such equipment. Any device capable of providing comparable control of hydrocarbon emissions may be used in lieu of the specified device.

HYDROCARBON EMISSIONS FROM STORAGE TANKS¹

Hydrocarbon emissions from storage vessels depend on three basic mechanisms: breathing loss, working loss, and standing storage loss. Breathing and working losses are associated with cone-roof tanks² (Figure 10), and standing storage losses are associated with floating-roof tanks (Figures 11, 12, and 13).

Breathing losses are hydrocarbon vapors expelled from the vessel by expansion of existing vapors due to increases in temperature or decreases in barometric pressure. Working losses are hydrocarbon vapors expelled from the vessel during emptying or filling operations. Emptying losses result from vapor expansion caused by vaporization after product withdrawal. Filling losses are the amount of vapor (approximately equal to the volume of input liquid) vented to the atmosphere by displacement.

Breathing and emptying losses are usually restricted to fixed-roof tanks vented at what is essentially atmospheric pressure. Filling losses are experienced in fixed-roof tanks and low-pressure storage tanks vented to the atmosphere. Both working losses and breathing losses can be significant and are therefore taken into consideration when proposing the standards.

Standing storage losses are hydrocarbon emissions from floating-roof tanks. They are caused by the escape of vapors through the seal system between the floating roof and the tank wall (Figure 14), the hatches, glands, valves, fittings, and other openings.

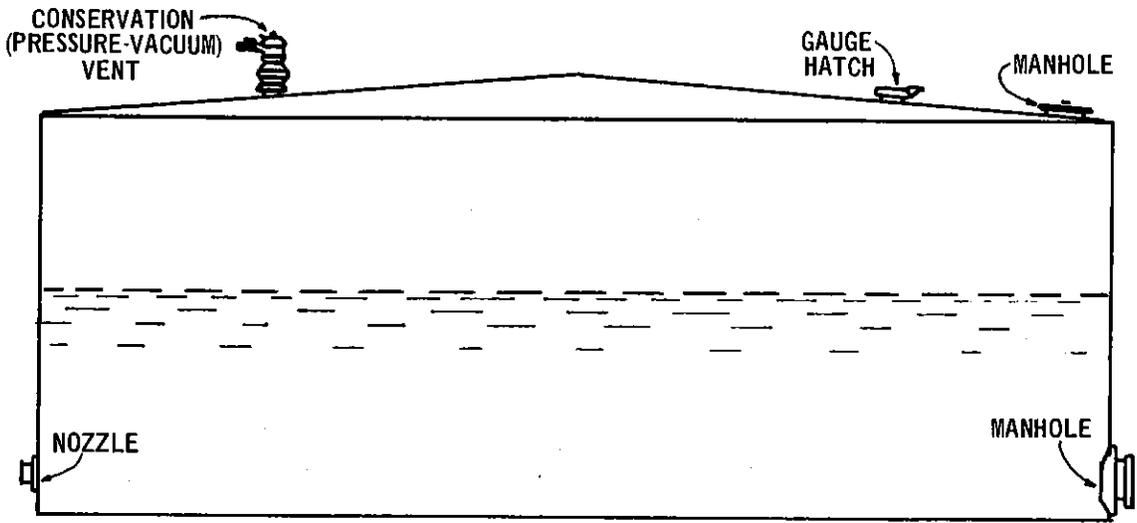


Figure 10. Fixed-roof (cone-roof) storage vessel.

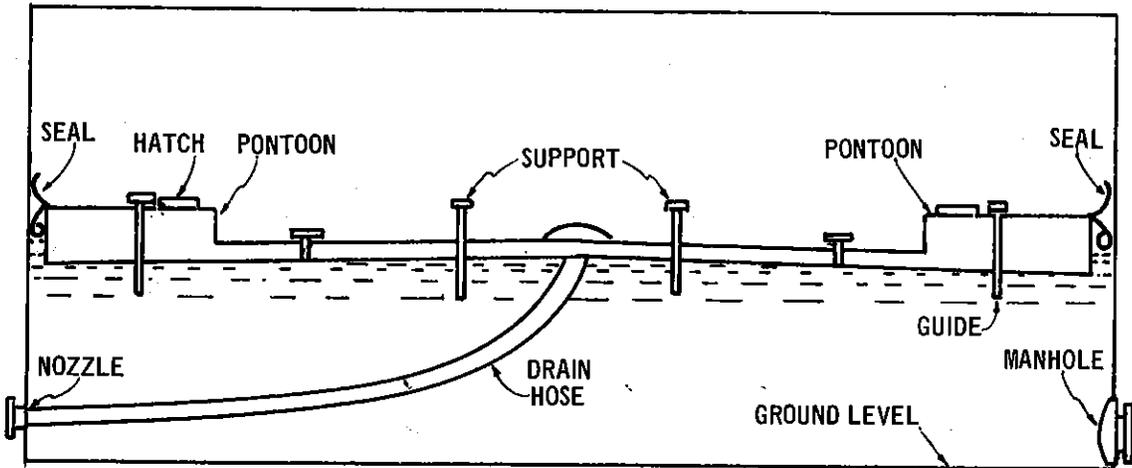


Figure 11. Single-deck floating-roof storage vessel.

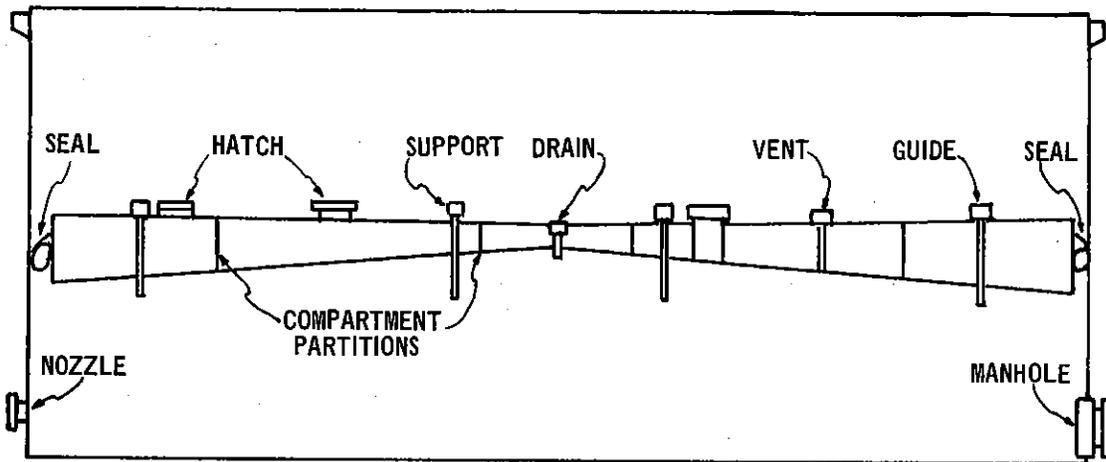


Figure 12. Double-deck floating-roof storage vessel.

Gulf Coast of the United States. Vapor pressures greater than 11.1 psia would probably occur in such an area over a very short period in the fall when winter-grade gasolines are accumulated in storage for shipment north. During this period, Gulf Coast ambient temperatures remain high. However, data obtained from Gulf Coast refineries, where the worst climatic conditions are likely to be encountered, show that essentially all gasolines and most blending components can be stored in floating-roof tanks in any part of the country if the proposed standard is used. This is contingent upon using water cooling systems designed and properly operated to ensure adequate cooling of the product prior to storage.

Beyond a true vapor pressure of 11.1 psia, losses from a floating-roof tank increase very rapidly, and surface boiling, with concurrent high losses, is likely to occur. Accordingly, storage of materials having a true vapor pressure greater than 11.1 psia at actual storage conditions should be controlled by vapor recovery systems, pressure storage, refrigeration, or combinations thereof.

Vapor recovery systems have been used to a small extent to control hydrocarbon emissions from large tank farms and bulk terminals, and were considered as a possible means of controlling emissions from the storage of all liquids with high true vapor pressures. However, they have not been demonstrated to be reliable in all areas of the country. These systems have generally been reliable in regions of moderate climate where excessive, long-term vapor loads on the system caused by high summer temperatures are minimized. In addition, when a vapor recovery system is shut down by compressor failure or for maintenance, no controls exist for the entire tank farm.

ENVIRONMENTAL IMPACT OF PROPOSED STANDARDS

A substantial portion of the hydrocarbon emissions from storage tanks are compounds that react in the atmosphere to form photochemical oxidants. Typical emissions from gasoline storage tanks are C₄ through C₆ paraffins, C₄ and C₅ olefins, and small quantities of propane. Available information indicates that all of these compounds, with the exception of propane, are photochemically reactive.

No adverse environmental effects will occur as a result of meeting the requirements of the proposed standard. Floating-roof tanks and conservation vents increase and preserve the yield of salable products. Hydrocarbons collected in vapor recovery systems are normally recycled to the refinery. In no case will the standard cause the generation of solid or liquid wastes.

ECONOMIC IMPACT OF PROPOSED STANDARDS

Over the next 5 years, approximately 175 new gasoline storage tanks and 420 new crude oil storage tanks will be constructed annually in the United States. The number of new storage tanks depends on the growth rate of the crude oil refining industry, on gasoline production, and on the actual size of the tanks constructed. The estimated annual growth rate for both crude oil refining and gasoline production is 4 percent. This growth rate will require storage for approximately 20,900,000 barrels of crude oil and 12,500,000 barrels of gasoline annually. The growth in production of military jet naphtha, the least volatile material covered by the proposed standards, is uncertain but will probably be small. For this reason national investment-cost projections have not been made.

Tanks storing crude oil, gasoline, and petroleum distillates having a true vapor pressure greater than 1.52 psia require a floating roof to meet the proposed standard. The increased investment cost over a cone roof is 12 to 25 percent, depending on size. However, the savings from the product recovered exceeds the annualized cost of the floating-roof installation when storing gasoline or when storing crude oil in tanks greater than 20,000-barrel capacity. For an 80,000-barrel jet-naphtha-fuel tank under average storage conditions, the annual cost is estimated at \$1,000, or 0.1 cent per barrel of throughput. Costs for two sizes of tanks are shown in Table 5.

**Table 5. CONTROL COSTS FOR
PETROLEUM STORAGE TANKS**

Tank capacity, bbl	Incremental investment cost above cone- roof tank, \$	Material stored	Annual cost, \$
20,000	20,000	Gasoline	savings 1,140 ^a
		Crude oil	480
		Jet naphtha	2,100
80,000	27,000	Gasoline	savings 11,100
		Crude oil	savings 5,200
		Jet naphtha	1,000

^aSavings from the product recovered exceed the annualized cost.

Vapor recovery systems are required for some of the materials covered by the standard. These systems are considerably more costly than floating roofs. For some products (for example, winter-grade northern gasolines and gasoline-blending stocks) having a true vapor pressure greater than 11.1 psia, the incremental recovery over a floating-roof tank with a capacity of 50,000 barrels is 7 percent. If the increase in control costs for the vapor recovery system is divided by the increased product recovered, the cost per barrel is about 20 times the average control cost per barrel for the floating-roof system. However, proper cooling at the production unit will keep the true vapor pressure of these materials below 11.1 psia at actual storage conditions.

Other materials with a true vapor pressure greater than 11.1 psia at actual storage conditions must be stored in vessels controlled by vapor recovery systems, or their equivalents, regardless of cost in order to prevent excessive losses caused by surface boiling.

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TECHNICAL REPORT NO. 10 - SECONDARY LEAD SMELTERS AND REFINERIES

SUMMARY OF PROPOSED STANDARDS

Standards of performance being proposed for new secondary lead smelters and refineries would limit emissions of particulate matter (including visible emissions) from blast (cupola) and reverberatory furnaces. Pot furnaces with a charging capacity of more than 250 kilograms (550 pounds) would be subject to visible emission limitations only.

Standards for Particulate Matter from Blast and Reverberatory Furnaces

The proposed standards would limit particulate emissions from blast and reverberatory furnaces to the atmosphere as follows:

1. No more than 50 mg/Nm³ (undiluted), or 0.022 gr/dscf.
2. No more than 20 percent opacity.

The proposed visible emission standard is compatible with the mass emission limit for blast and reverberatory furnaces; if particulate emissions are at or below 50 mg/Nm³, visible emissions will be below 20 percent opacity. Observations of pot furnaces have shown that visible emissions will be less than 10 percent opacity if commonly used dust equipment is installed and properly maintained.

Standard for Particulate Matter from Pot Furnaces

The proposed standard for pot furnaces will limit visible emissions to less than 10 percent opacity.

EMISSIONS FROM LEAD FURNACES

A poorly controlled (80 to 85 percent collection efficiency) secondary lead furnace can release 30 to 40 pounds of dust and fume per ton of lead produced.¹ Such installations are likely to be equipped with centrifugal dust collectors, settling chambers, or low-energy scrubbers. The approach results in a loss of valuable product,² since average smelter dust is estimated to be 63 percent lead,³ and the dust can amount to 2 percent of the lead product. On the basis of this poorly controlled emission rate, a collection efficiency of about 97 percent is required to meet the particulate standards.

At well controlled secondary lead smelters (Figure 16), either baghouses or high-energy scrubbers are used to collect dust and fumes from the furnace. When fabric filters are used to control blast furnace emissions, they are normally preceded by an afterburner (Figure 17) to incinerate oily and sticky materials to avoid blinding the fabric. This afterburner has the added advantage of converting carbon monoxide to carbon dioxide. An afterburner is not needed in the reverberatory furnace (Figure 18) since the excess air and temperature are sufficient to incinerate carbon monoxide and hydrocarbons.

Emissions from blast and reverberatory furnaces are normally released into the atmosphere through stacks with an average height of 150 feet; however, stack heights may range from a few feet above the top of the control device (about 30 feet above ground level) to 300 feet.

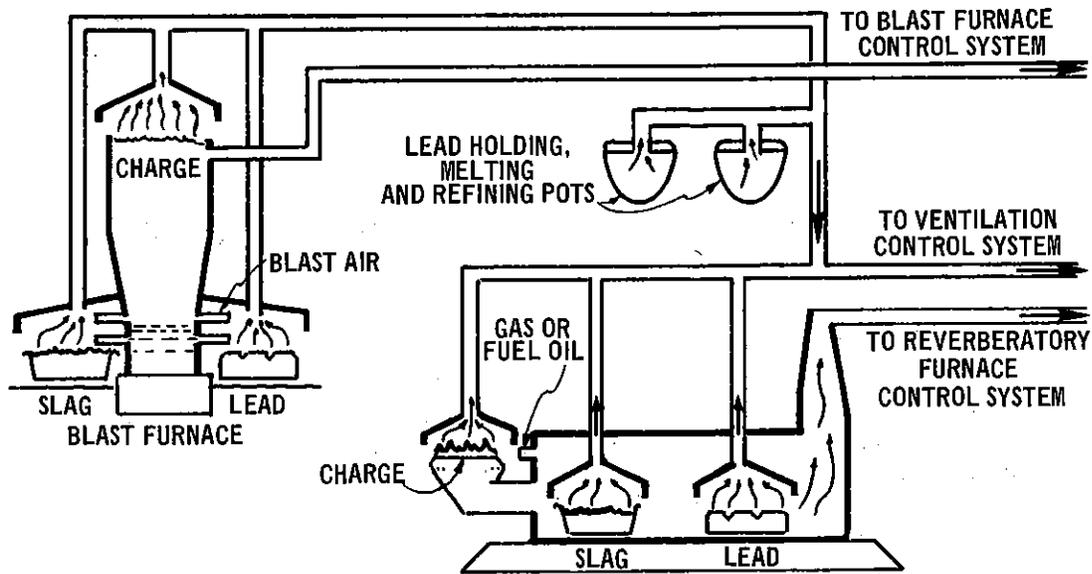


Figure 16. Secondary lead smelter process.

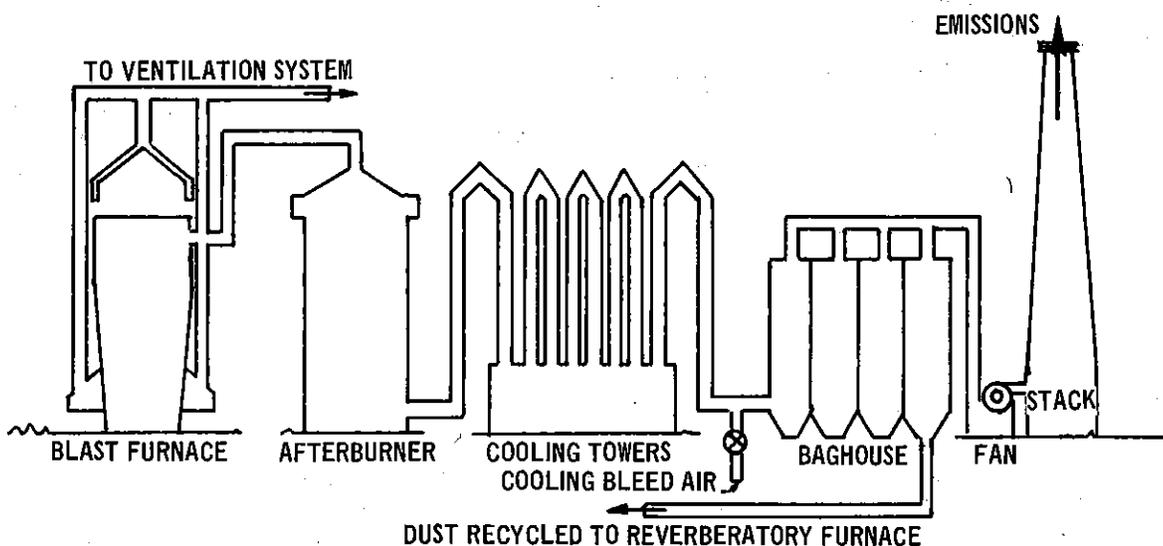


Figure 17. Controlled lead blast furnace, afterburner and baghouse.

Baghouses and scrubbers are also used to control pot furnaces (Figure 19). During melting and holding operations associated with pot furnaces, uncontrolled emissions are quite low because the vapor pressure of lead is low at the melting temperature. During dross skimming and refining operations, emissions are substantially increased, and adequate ventilation must be provided to protect the health of the workers. The latter requirements govern the volume of exhaust gases. Emissions from pot furnaces are typically released into the atmosphere through short stacks, 15 to 35 feet in height.

State and local particulate regulations are less stringent than the proposed standards for blast and reverberatory furnaces. The most stringent standards restrict particulate emissions from 20- to 80-ton furnaces to from 4 to 8 lb/hr, which corresponds to from 0.02 to 0.08 gr/dscf. Some of these standards are based on particulate sampling methods that differ from the EPA technique in that they include material collected in wet impingers.

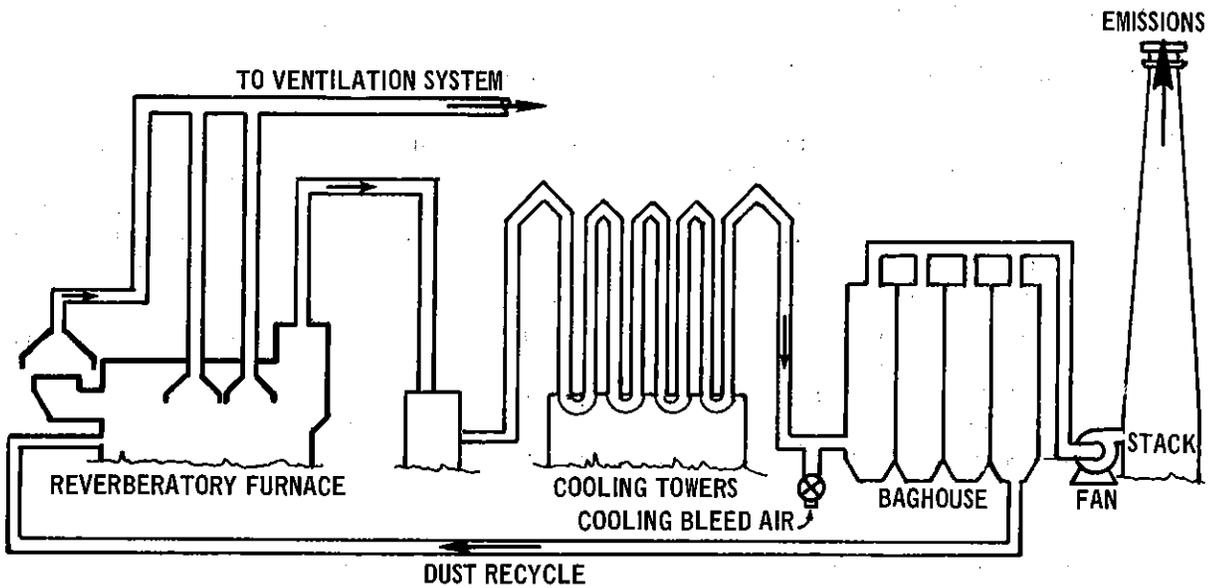


Figure 18. Controlled lead reverberatory furnace, baghouse.

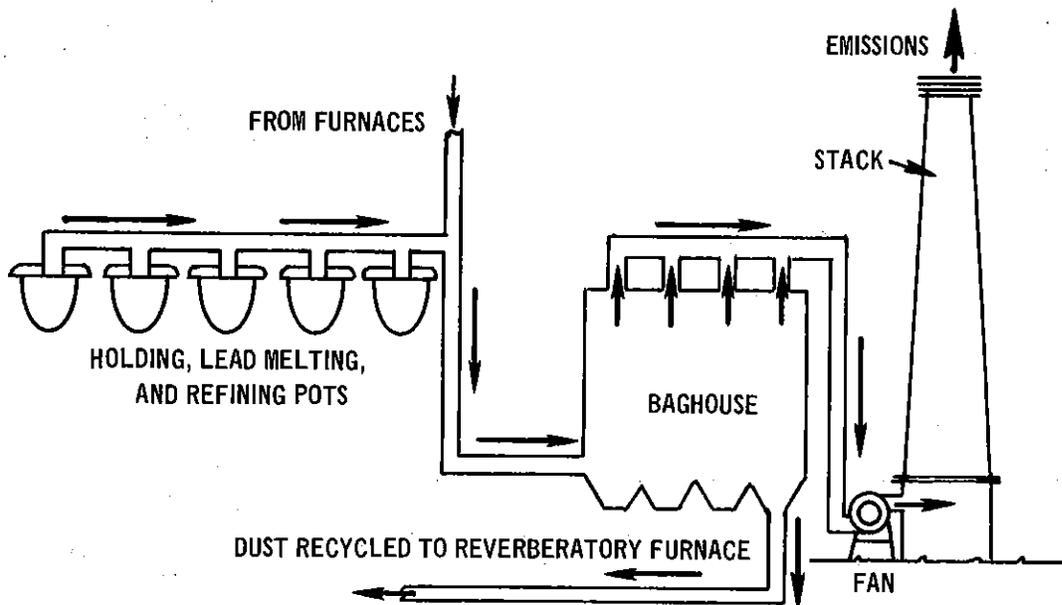


Figure 19. Controlled lead pot and ventilation system, baghouse.

For a typical blast (cupola) furnace rated at 50 tons/day at a flow rate of 15,000 dscf, the proposed standard will allow the furnace to emit 2.6 lb/hr of particulate matter. The reference process weight regulation (Table 1) will limit emissions to 7.7 lb/hr for a charging rate of 6900 lb/hr. New furnaces will range in size from 20 to 80 tons/day in ingot production, with respective gas flow rates of 10,000 to 40,000 dscfm.

RATIONALE FOR PROPOSED STANDARDS

Particulate Matter from Blast and Reverberatory Furnaces

Preliminary investigations revealed the location of 11 well controlled plants. These plants were visited, and information was obtained on the process and control equipment. Visible emissions at the plants were observed to be less than 10 percent opacity. The feasibility of stack testing was determined in each case. Six locations were unsatisfactory for testing because control equipment was inadequate or because the physical layout of the equipment made testing unfeasible. Stack tests were conducted at five locations, including three blast and two reverberatory furnaces.

All furnaces tested showed average particulate emissions below the proposed standard (Figure 20). The blast furnaces were controlled by (1) an afterburner and baghouse; (2) an afterburner, baghouse, and venturi scrubber; and (3) a venturi scrubber. Particulate emissions averaged, respectively, 0.003, 0.009, and 0.015 gr/dscf. The reverberatory furnaces were controlled by baghouses, with particulate emissions averaging 0.004 gr/dscf in both cases.

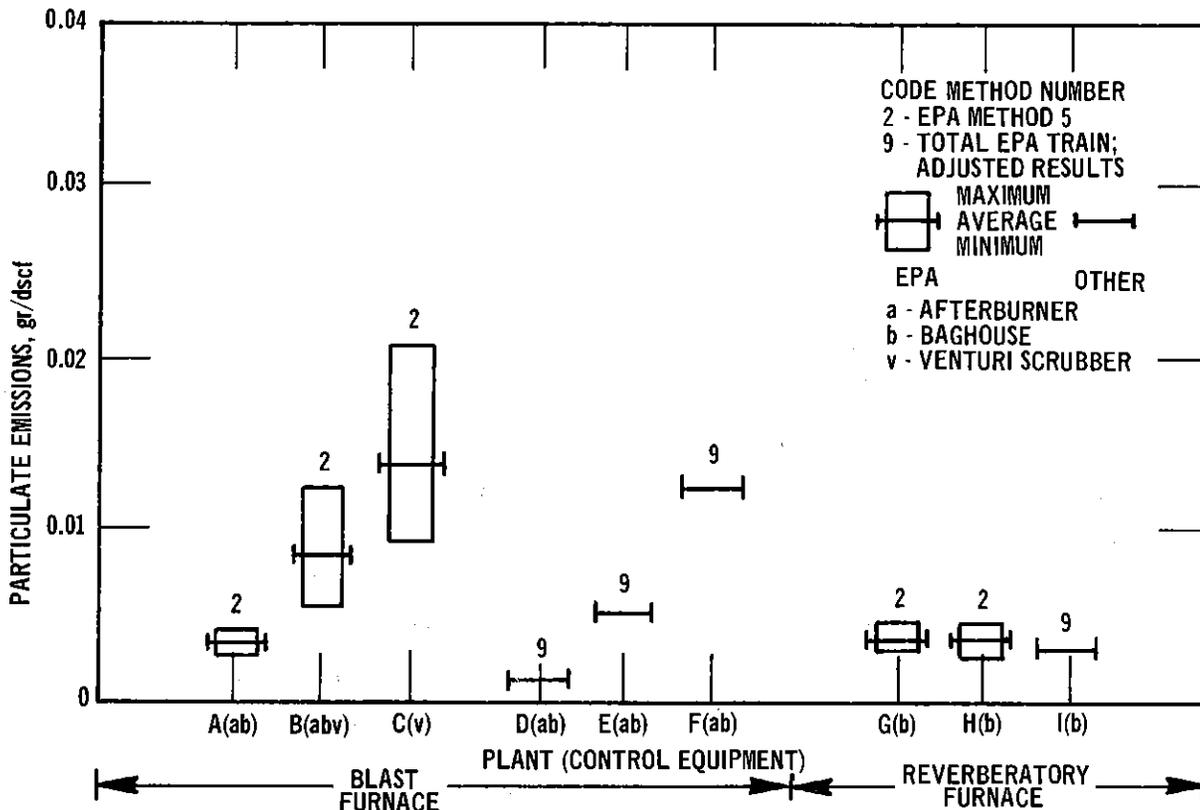


Figure 20. Particulate emissions from secondary lead smelters and refineries, blast and reverberatory furnaces.

Previous tests on three blast furnaces and a reverberatory furnace conducted by a local control agency⁴ are also shown in Figure 20. The blast furnaces were controlled by an afterburner and a baghouse; the reverberatory furnace was controlled by a baghouse. Particulate emissions averaged, respectively, 0.001, 0.005, 0.012, and 0.003 gr/dscf. The test method is considered comparable to the EPA method.

Designers and manufacturers of control equipment will guarantee efficiencies that achieve outlet concentrations between 0.015 and 0.020 gr/dscf.

No visible emissions were observed at three of the furnaces tested; the other two had visible emissions of 15 percent opacity or less. Six additional furnaces were observed by EPA engineers to have visible emissions within the proposed standard, although moisture-condensation plumes were present in cold weather from those furnaces controlled by scrubbers.

Standard for Particulate Matter from Pot Furnaces

Other than visible emission limits, no emission standard has been proposed for pot furnaces. Nine smelters with pot furnaces controlled by baghouses or high-energy scrubbers have been observed to have visible emissions less than 10 percent opacity. It is estimated that particulate emissions are less from pot furnaces than from blast and reverberatory furnaces, but no tests have yet been conducted.

ENVIRONMENTAL IMPACT OF PROPOSED STANDARDS

No significant quantity of solids will require disposal as a result of implementing the proposed standard since, in most instances, the collected solids are lead compounds that are recycled back to the process.

The predominant control devices for the secondary lead industry are expected to be fabric filters, along with a small number of high-energy scrubbers. Dust collected in baghouses can be recycled directly back to the furnace. When wet scrubbers are used, settling tanks and ponds have been installed to precipitate the collected solids. The precipitate is removed, dried, and fed back to the furnace. Scrubbing water will pick up sulfur dioxide from the gas stream, causing the water to become acidic. Alkali can be added to the scrubber to control pH. Salts that precipitate with collected dust are also returned to the furnace and usually become part of the slag.

ECONOMIC IMPACT OF PROPOSED STANDARDS

At the end of 1971, there were 23 firms operating approximately 45 secondary lead smelting plants in the United States. The four largest companies account for approximately 72 percent of the output. Total production has been cyclical but tending upward at a yearly rate of 3.2 percent. Consumption of lead-acid storage batteries, the major market for secondary lead, has been growing at a rate of 5.1 percent annually. In general, the industry expects these trends to continue, with no major problems in the foreseeable future.

It is anticipated that two new secondary lead plants will be installed and one to two plants will be modified in the United State each year. Table 6 gives estimates of control costs for two model units representative of the size and type expected to be installed. For a new plant consisting of a blast furnace rated at 50 tons/day with auxiliaries, two abatement alternatives were analyzed. If an afterburner, U-tube cooler, and fabric filter were installed, the annualized control costs (including charges for labor, materials, utilities, depreciation, interest, property taxes, and an allowance for recovered materials) would amount to about to about \$4.05/ton of output. In the worst-case situation (that is, if the costs could not be passed forward or backward) this level of expense would cause a reduction in typical net earnings of approximately 15 percent. If the alternative venturi scrubber system were installed, annualized costs would amount to approximately \$6.40/ton of output. This approach would reduce typical net earnings about 25 percent in the worst-case situation.

For a new secondary lead plant consisting of a reverberatory furnace rated at the same capacity and having equivalent auxiliary equipment, two similar abatement alternatives were considered. In this case, however, afterburners need not be added to prevent blinding of the baghouse filter material. If a U-tube cooler and fabric filter were installed, annualized costs for the control equipment would be about \$1.65/ton of product. With no ability to shift costs, this approach would reduce typical net income approximately 7 percent.

**Table 6. CONTROL COSTS OF MEETING
PERFORMANCE STANDARD (0.022 gr/dscf)
FOR TYPICAL SECONDARY LEAD PLANTS^a**

Plant type	Required control equipment	Control investment, \$	Annual cost, \$/yr	Annual cost per unit of production, \$/ton
Blast furnace, 50 tons/day	Afterburner, U-tube cooler, fabric filter	157,000	51,000	4.05
	Afterburner, water quench, venturi scrubber	123,000	80,000	6.40
Reverberatory furnace, 50 tons/day	U-tube cooler, fabric filter	188,000	21,000	1.65
	Water quench, venturi scrubber	125,000	36,000	2.86

^aMajor assumptions: (1) production rate, 4,000 lb/hr; (2) annual production, 12,500 tons; (3) recoverable dust is recycled at a value of 2.25 cents/lb, except for reverberatory dust recovered from fabric filters at value of 4.5 cents/lb; (4) fabric filter systems depreciated straight-line, 15-year life; (5) venturi scrubber systems depreciated straight-line, 10-year life; and (6) estimated average product price \$320/ton.

If the alternative control system, consisting of a water quench and venturi scrubber, were installed, the annualized control costs would be approximately \$2.86/ton of output and would reduce typical net income about 12 percent.

The costs shown in Table 6 are total in the sense that they account for complete control systems added to new, uncontrolled plants. The incremental control costs to meet the proposed standard beyond those required to meet the reference process weight standard are minimal. Many State and local agencies presently have regulations for secondary lead smelters that require the same types of dust-control equipment necessary under the proposed standards. The industry has also practiced relatively effective control in the past in order to minimize occupational health hazards.

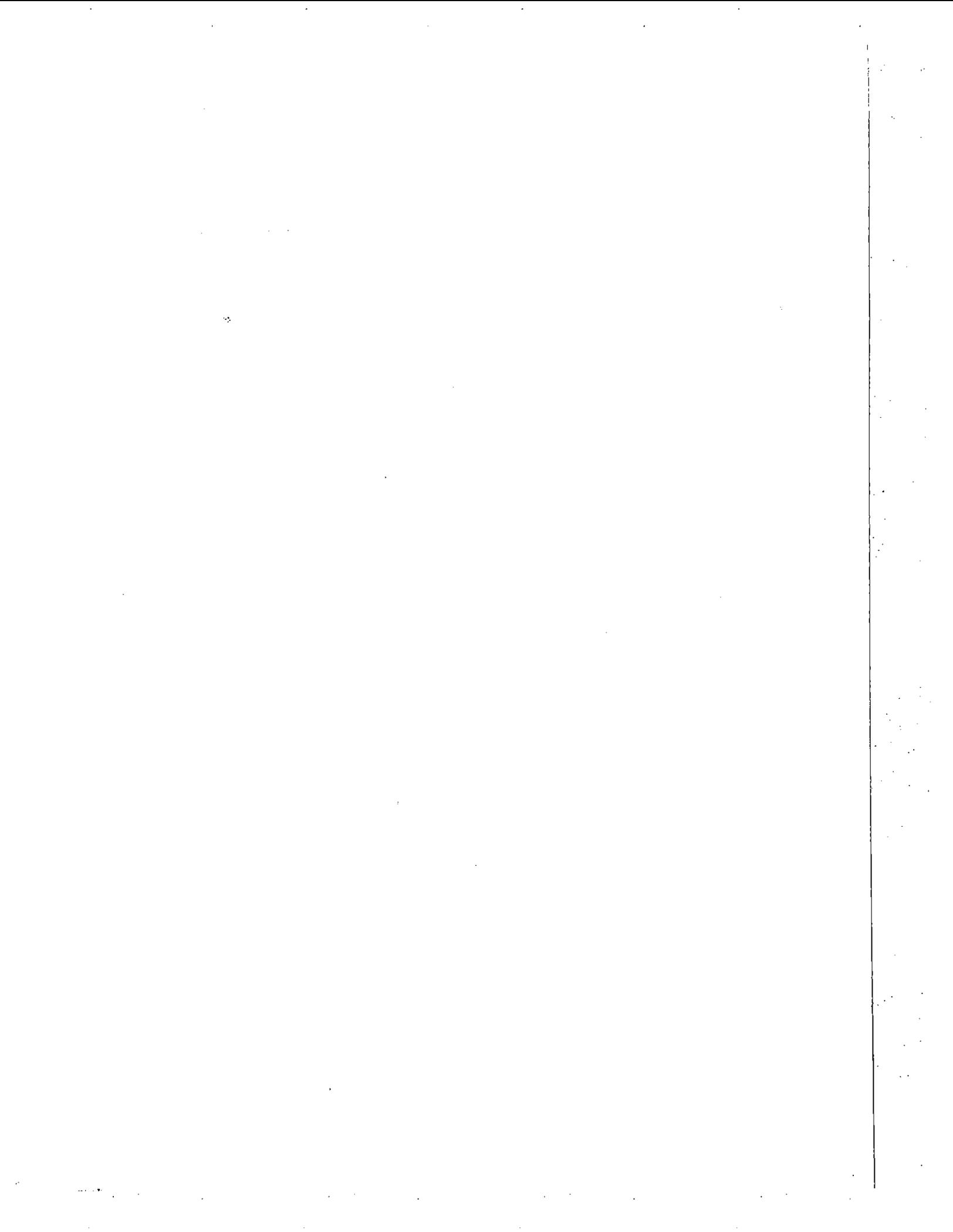
It is estimated that the 1967 level of control for the industry was 90 percent. New secondary lead facilities will be introduced into a market situation in which the price of the product or the prices paid for raw material scrap already reflect, to some degree, the increased expenses from air pollution control. Since the incremental control costs for a new plant versus an existing unit are minimal, profitability at least equaling that of existing industry should be achievable for a new unit.

Secondary producers compete with their primary counterparts and are subject to the cyclical nature of the lead industry as a whole. Total control costs for the secondary facilities are small in absolute terms and in relation to the expected control costs for the primary producers. Control costs for the primary facilities are on the order of \$0.022/lb, or \$44/ton. Costs for new secondary plants are in the range of \$2/ton to \$6/ton. With full implementation by both types of producers, secondary lead producers should not be placed at a competitive disadvantage.

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2. Brainbridge, C.A. Fume Control and Recovery in Lead Smelting Furnaces. Chemical and Process Engineering. August 1960.
3. Bray, J.L. Non-Ferrous Production Metallurgy (2nd Ed.). New York, John Wiley and Sons, Inc. 1953.
4. Williamson, J.E., J.F. Nenzell, and W.E. Zwiacher. A Study of Five Source Tests on Emissions from Secondary Lead Smelters. County of Los Angeles Air Pollution Control District. Los Angeles, Calif. Order No. 2PO-68-02-3326. 1972. 45p.



TECHNICAL REPORT NO. 11 - SECONDARY BRASS OR BRONZE INGOT PRODUCTION PLANTS

SUMMARY OF PROPOSED STANDARDS

The proposed performance standards for new secondary brass or bronze ingot production plants will limit particulate emissions (including visible emissions) from reverberatory furnaces and will limit visible emissions from electric and blast (cupola) furnaces. The standards will apply to batch furnaces with a capacity of 1000 kilograms (2205 pounds) or greater per heat, and to continuous (blast) furnaces capable of producing 250 kilograms (550 pounds) or more of metal per hour. The standards do not apply to the manufacture of brass or bronze from virgin metals or to brass or bronze foundry operations. Furthermore, the standards apply to particulate emissions from furnaces only. Other sources of particulate emissions may exist in plants affected by the proposed standards, but further study will be required to delineate such sources and to recommend appropriate levels of control.

No mass standard is proposed for electric and blast furnaces because (1) 95 percent of the production is carried out in reverberatory furnaces, (2) the emissions from blast furnaces are about the same as those from reverberatory furnaces and far less than those from electric furnaces, (3) well controlled blast and electric furnaces can meet the visible emission standard, (4) the expenditure of EPA resources for the testing needed to support a specific mass standard is not warranted, and (5) the visible emission standard is an adequate enforcement criterion and can be met only by well controlled units.

Standards for Particulates from Reverberatory Furnaces

The proposed standards will limit emissions to the atmosphere as follows:

1. No more than 50 mg/Nm³ (undiluted), or 0.022 gr/dscf.
2. No more than 10 percent opacity.

Standard for Particulates from Electric and Blast Furnaces

The opacity of visible emissions shall be no more than 10 percent.

EMISSIONS FROM SECONDARY BRASS AND BRONZE FURNACES

Particulate emissions from brass and bronze furnaces (Figure 21) vary with the content of the alloy being produced, and with the presence of impurities in the scrap feed. Most of the particulate emissions are metal oxides, predominantly zinc oxides (45 to 77 percent) and lead oxides (1 to 13 percent). Uncontrolled reverberatory furnaces can emit as much as 80 pounds of particulate matter per ton of ingot produced. The level of emissions from blast furnaces (cupolas) is approximately equal to that from reverberatory furnaces; the level of emissions from electric furnaces is typically far lower.^{1,2,3} The composition of emissions from blast furnaces is similar to that from reverberatory furnaces.^{1,2} Emissions from electric furnaces are also expected to be similar because the process and raw materials are identical.

Fabric filters are extensively used to control emissions from all three types of furnace; only recently have electrostatic precipitators been adopted as control devices. Although no scrubber has yet been used to control emissions to the level of the proposed standard, such levels are within the capability of scrubbing technology.

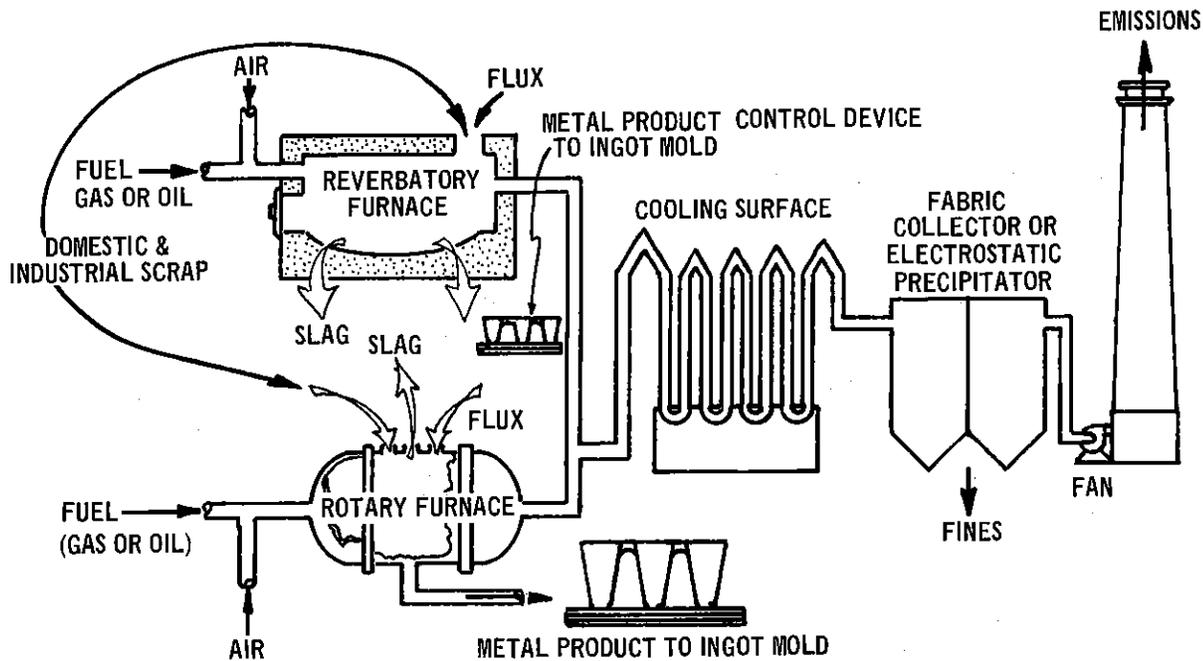


Figure 21. Controlled secondary brass and bronze furnaces.

No State or local agency now has an emission standard specifically for the brass and bronze industry. General restrictions applied to this industry are based on the process weight regulations or on emission concentrations.⁴ These concentration restrictions range from 0.05 to 0.3 gr/scf. Some restrictions are based on particulate sampling methods that differ from EPA method 5 because they include material collected in a wet impinger.

The reference process weight regulation (Table 1) would restrict emissions from a typical 25-ton brass furnace (24-hour cycle) to 3.6 lb/hr. The proposed mass standard is more restrictive than any existing process weight curve for furnace sizes appropriate to the brass and bronze industry. The standard will limit these emissions to between 1.0 and 1.5 lb/hr.

Lead emissions during production of a 5 percent lead alloy comprised 4 to 7 percent of the total particulate matter emitted. Production of alloys with a higher lead content would probably increase the lead content of the total emissions. Because there is no known control technique specific for lead, the maximum possible control of lead emissions can be obtained by using the most effective particulate collectors.

RATIONALE FOR PROPOSED STANDARDS

Based on the results of preliminary screening, eight plants were inspected as candidates for source testing. Visits to these plants revealed that five plants operated with no visible emissions. Four of these five were selected for source testing, and three plants were successfully tested. The fourth test was aborted because plant malfunctions during testing rendered the test results invalid.

Particulate Matter from Reverberatory Furnaces

All furnaces tested by EPA showed average particulate emission rates below the proposed standard. Emission rates from the reverberatory furnaces, all controlled by fabric filters, averaged 0.001, 0.006, and 0.008 gr/dscf.

At least three heats were tested at each plant. The tests began when the first scrap was charged into the furnace and ended when the pouring of ingots began. The pouring phase of the heats was not tested because none of the facilities adequately collected the emissions from this phase of the heat. During some of the tests, individual samples were collected during different phases of the

heats in order to determine fluctuations of emissions during the heat. The EPA data points in Figure 22 represent plant emission levels determined by averaging the data acquired from the individual samples. Four of the 31 tests were aborted because of sampling irregularities or process upsets. These samples were not used to determine furnace emissions.

Results of other tests performed by Federal, State, and local agencies showed emission rates of 0.002, 0.005, 0.010, 0.0125, 0.014, and 0.017 gr/dscf from reverberatory furnaces. The furnaces tested, which ranged in production capacity from 7.5 to 100 tons, were all controlled by fabric filters.

During EPA tests at plants A and B (Figure 22), there were no visible emissions. At plant D, visible emissions of 10 percent opacity were observed during the fabric filter cleaning cycle. No visible emissions were reported for plants E and F, which were tested previously by EPA.

Particulate Matter from Blast and Electric Furnaces

Results of one blast furnace test revealed emissions of 0.013 gr/dscf; recent EPA inspections showed that the furnace operates with no visible emissions. Although no electric furnaces have been source-tested, it should not be difficult for electric furnaces to meet the proposed standards for reverberatory furnaces because their process cycle is similar.

ENVIRONMENTAL IMPACT OF PROPOSED STANDARDS

Fabric filters are the primary devices used to limit emissions from brass and bronze furnaces. Although scrubbers can be used to meet the proposed standards, it appears that new facilities will

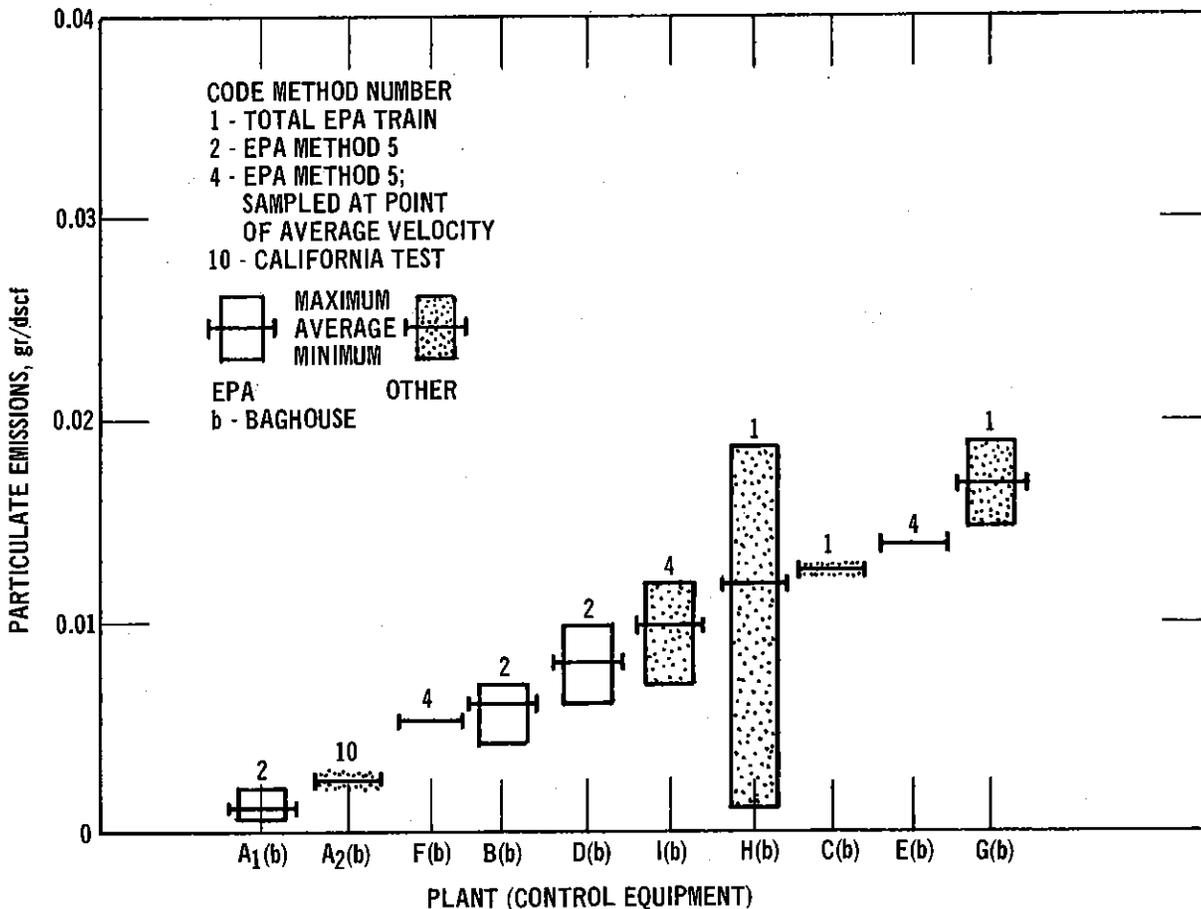


Figure 22. Particulate emissions from secondary brass and bronze ingot production industry, reverberatory and blast furnaces.

continue to use fabric filters. There is now only one brass and bronze facility that uses a wet scrubber (low efficiency). This facility utilizes settling ponds to separate collected solids and recycles the water in a closed-loop system.

Until recently, the particulate matter collected from brass and bronze furnaces was marketable; however, this market has been declining, and an excess of collected zinc and lead oxides now exists. Several methods of disposal are being used, some of which are: bagging, 55-gallon drums, open piles, and landfills. Techniques are available to prevent leaching and water contamination due to the storage of water-soluble solid wastes. For example, it is common practice in the chemical processing industry to use plastic-lined, watertight disposal pits in order to prevent leaching or runoff. Since the total annual tonnages involved in the brass and bronze industry are small (about 10,000 tons/yr for the entire industry), this disposal technique can be used if necessary.

ECONOMIC IMPACT OF PROPOSED STANDARDS

Brass and bronze ingot production has grown at an average annual rate of 1.2 percent over the last 10 years. Production reached a peak in 1965 and 1966 and has declined somewhat since that time. For this reason, it is believed that excess capacity exists in the industry and few, if any, new plants will be constructed in the next few years. It is probable, however, that some obsolete furnaces will need to be replaced. Such replacements are expected at a rate of one or two furnaces per year; these new furnaces will be required to comply with the new source performance standards.

Although there are a few wet scrubbers and electrostatic precipitators in use in the industry, the fabric filter has been the most common control device used in the past. The fabric filter will most likely be the control device used to meet the proposed new source performance standards. Control cost for different sizes of reverberatory furnaces are shown in Table 7.

It is possible to channel the exhaust from several furnaces into a common control system, and thus achieve the economy of a large-scale system. The extent that this economy can be realized will depend on the characteristics of the individual plant in which the furnace replacement is made.

The proposed standard is not likely to require expenditures above those already required by existing State or local standards.

**Table 7. CONTROL COSTS OF MEETING PERFORMANCE STANDARD
(0.022 gr/dscf) FOR REVERBERATORY FURNACES**

Furnace capacity, tons/day	Investment, \$	Annual cost, \$	Annual cost per ton of product, \$
20	74,000	13,000	6.52
50	110,000	20,070	4.01
75	130,000	34,300	3.24

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TECHNICAL REPORT NO. 12 - IRON AND STEEL PLANTS

SUMMARY OF PROPOSED STANDARDS

Standards of performance being proposed for the iron and steel industry will limit emissions of particulates, including visible emissions, from new basic oxygen process furnaces (BOPF's).

1. No more than 50 mg/ Nm^3 (undiluted), or 0.022 gr/dscf.
2. No more than 10 percent opacity.

The proposed standard for visible emissions is compatible with the 50-mg/ Nm^3 mass emission limit. The proposed particulate limits can be achieved with high-energy venturi scrubbers or electrostatic precipitators.

EMISSIONS FROM BASIC OXYGEN PROCESS FURNACES

In the steel industry, there are several processes that are major sources of particulate emissions if not properly controlled. These processes include the basic oxygen process; operation of open hearth, blast, and electric furnaces; and operation of coke ovens and sintering plants (Figure 23).

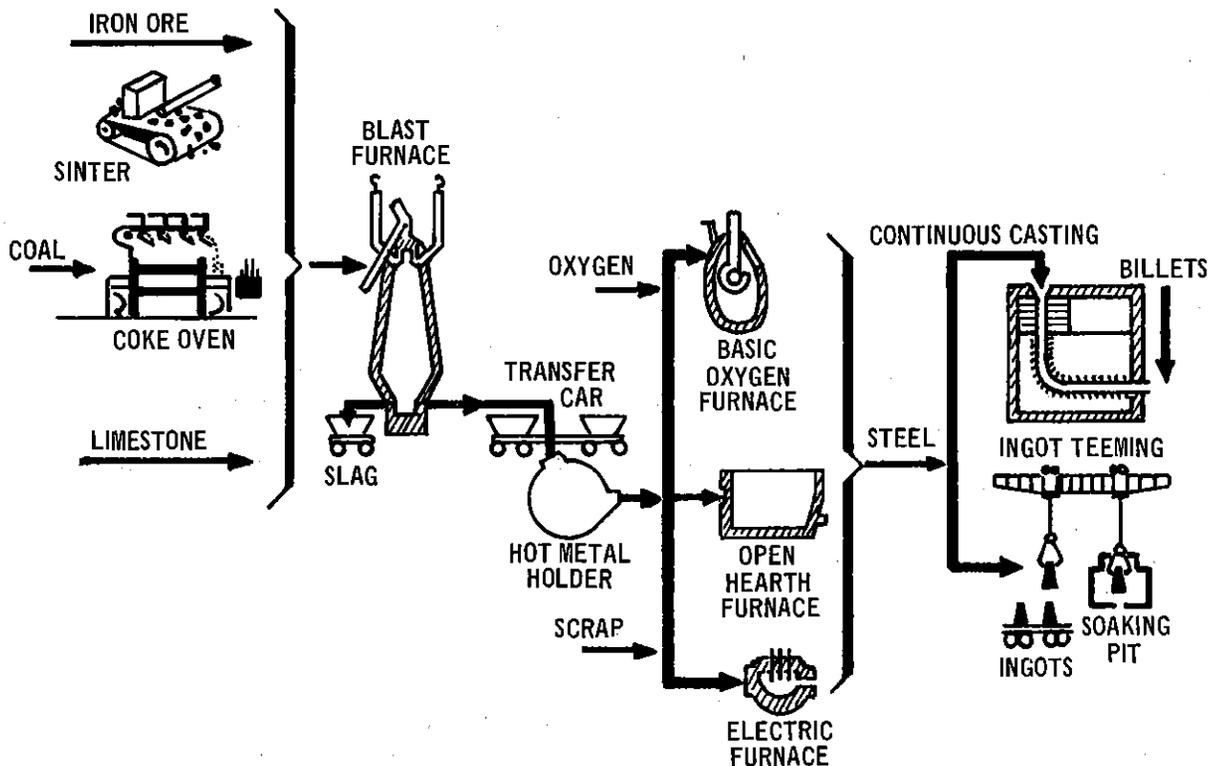


Figure 23. Iron and steel process system.

The proposed standards would apply only to basic oxygen process furnaces. Other pollutant sources in this industry will be covered by standards to be developed at a later date.

The BOPF is a vertical cylindrical container that is open at one end. During the steel-making process, oxygen at high velocity is directed at the surface of the molten mix, violently agitating the mix and causing a large quantity of particulate matter and carbon monoxide to be emitted through the open end of the furnace. As much as 40 pounds of particulate matter is emitted per ton of steel. The emissions are drawn into a hood, which is similar to that used with kitchen stoves to draw off steam and cooking odors. From the hood, the hot, dirty air is ducted to cleaning devices, usually electrostatic precipitators or high-pressure venturi scrubbers, which remove much of the particulate matter before the air is vented to the outside.

There are two different hood systems used to capture the BOPF emissions. One system uses an open (or combustion) hood, which has 1.5 to 2 feet of clearance above the furnace rim. The other system uses a retractable closed hood, which fits rather closely around the top of the furnace and prevents additional air from being drawn into the exhaust system.

The closed hood was designed to minimize the exhaust volume and to reclaim carbon monoxide. In many countries, this carbon monoxide is collected for use as a fuel or as a feed gas for petrochemical processing operations; however, in the two plants in the United States using closed hoods, the exhaust gases are currently flared with no heat recovery.

From an air pollution standpoint, there are two factors pertinent to closed hoods: (1) the high concentrations of combustible carbon monoxide make the hot gases potentially too hazardous to clean in the arcing electric field of an electrostatic precipitator (in the open hood, oxygen in the air reacts with carbon monoxide to form nonexplosive carbon dioxide) and (2) the rate of the volumetric flow (cubic feet of gas per minute) through the cleaning system and out the stack is less than 20 percent of the rate of flow in an open-hood system. The first factor limits the choice of cleaning equipment to a single type, the high-energy venturi scrubber. The second factor leads to lower stack emissions per unit time (pounds per hour) than with an open hood. This is true because the venturi scrubber achieves about the same degree of cleanliness (0.02 grain of particulate matter per cubic foot of air) whether it is fed extremely dirty air or moderately dirty air. (The extremely dirty air from the closed hood comes out just as clean as the moderately dirty air from the open hood.) The amount of particulate matter coming out of the stack per unit time (pounds per hour) is dependent, therefore, upon how many cubic feet of air come out of the stack per unit time. As previously mentioned, the air flow in a closed system is less than one-fifth that of the open system, and the emission of particulate matter would be correspondingly lower.

Both open and closed hoods allow some air contaminants to escape through the roof ventilators to the atmosphere during charging, turn down, tilting, tapping, and ladle additions. Because the closed hood may be withdrawn to the up position during these operations, it is less efficient in collecting resultant emissions. During the oxygen blow, a small portion of the particulate matter also escapes to the building ventilation system, regardless of the collection device used. Collectively, these uncaptured emissions are estimated to be only a small percentage of the total quantity from BOPF's.

In the United States, BOPF's range from 100 to 325 tons in capacity. Emission volumes vary from 200,000 to 600,000 dscfm for open-hood systems. A typical 250-ton furnace has a gas volume of 200,000 to 500,000 dscfm. With a 90 percent yield and a particulate concentration of 0.022 gr/dscf, the furnace would produce 470 tons of steel and emit between 36 and 90 pounds of particulate per hour, depending on the quantity of excess air permitted to enter the combustion hood.

The requirements of existing State and local regulations that are specifically for BOPF facilities range from 0.1 to 0.2 lb/1000 lb of stack gas. This limitation is equivalent to 0.045 to 0.090 gr/scf. Such regulations would permit the furnace in the example given above to emit 77 to 386 pounds of particulate per hour. State limitations submitted pursuant to Section 110 of the Clean Air Act will require control only slightly less stringent than the new source standard.

RATIONALE FOR PROPOSED STANDARDS

In an investigation of 14 steel companies, which operate 26 of the 36 BOPF facilities in the United States, it was found that 12 were well controlled plants. From these 12, five were chosen for actual emission testing in order to obtain data on a wide range of furnace sizes (140 to 325 tons) and on the three basic types of emission control systems. The control systems are: the open hood with a high-energy scrubber, the open hood with an electrostatic precipitator (both illustrated in Figure 24), and the closed hood with a high-energy scrubber (Figure 25).

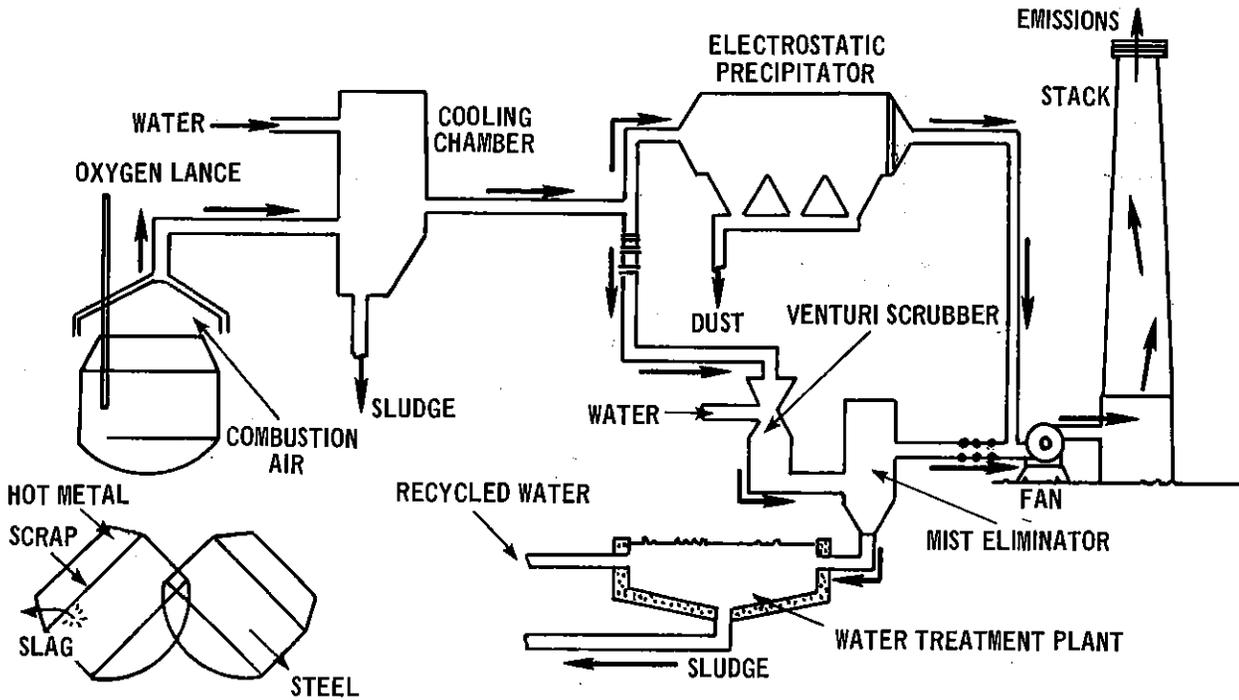


Figure 24. Controlled basic oxygen furnace, open hood with scrubber or electrostatic precipitator.

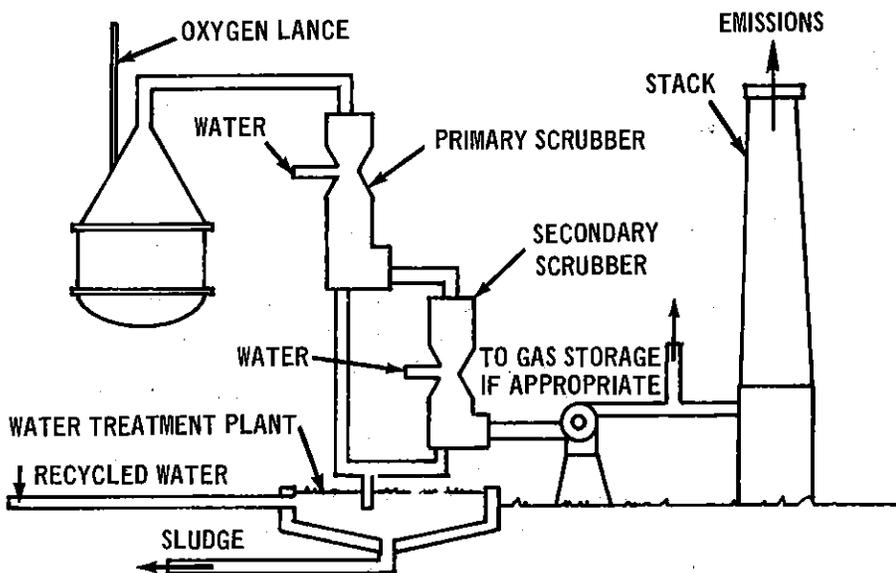


Figure 25. Controlled basic oxygen furnace, closed hood with scrubber.

Three of the five plants tested had average particulate emissions below the proposed standard. Figure 26 shows the results of the tests. Plants A and B were equipped with closed hoods and high-energy venturi scrubbers. Test A₁ is a second test of the same facility 2 months after test A₂. In plants C and E, open hoods and electrostatic precipitators were used. Plant D was equipped with an open hood and a venturi scrubber. (Emissions from plant D included some particulate matter that was formed from supplementary fuel oil that was burned in the hood to provide a more uniform heat source for generation of steam in the hood cooling coils.)

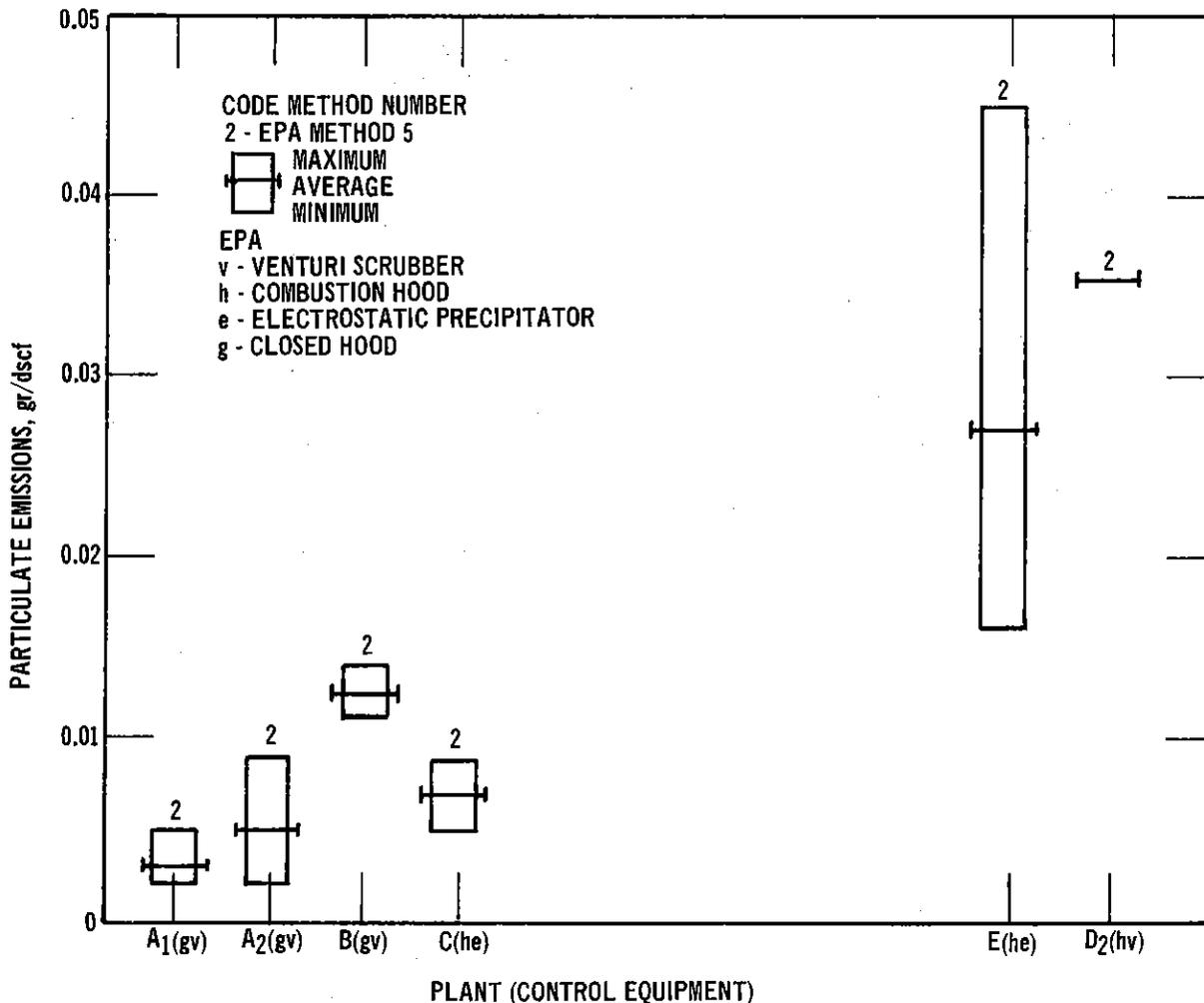


Figure 26. Particulate emissions from iron and steel industry, basic oxygen process furnaces.

A series of three runs comprised a test of a BOPF, each run lasting approximately 2 hours, long enough to include from four to six heats. Two of the three runs performed on plant D were invalid because rupture of the filters prevented accurate calculation of particulate concentration. Of the remaining 16 runs at the five facilities, 14 showed emissions of less than 0.022 gr/dscf.

The length of the sampling period was designed to permit measurement of all emissions controllable with existing technology. By beginning the test immediately after the furnace was charged and ending it immediately prior to tapping, it was possible to use data on emission from the preheat, oxygen blow, and all reblows in preparing the standard.

Test results show that the proposed concentration standard of 0.022 gr/dscf is representative of the lowest particulate concentration that can be achieved by control devices for BOPF emissions.

They also reveal that the closed hood, which prevents induction of ambient air into the hood, minimizes the mass emission rate of particulate matter from the process. Designers and manufacturers of control equipment will guarantee efficiencies that will achieve an average outlet concentration of 0.020 gr/dscf from either open- or closed-hood collection devices.

Existing open-hood systems are characterized by widely varying gas flow rates. For instance, an open-hood system applied to a 250-ton furnace might handle as little as 150,000 dscfm or as much as 500,000 dscfm, depending on the control equipment and operating practices of the particular firm. The lowest gas flows are used with scrubbers and the highest with precipitators, where there is a serious explosion hazard. If the technology were sufficiently developed, the regulation would include limits on exhaust gas flow rates in open-hood systems, thereby further restricting mass emissions into the atmosphere. Because of explosion hazards, such a secondary limitation is not practical at this time if dry collectors (electrostatic precipitators and fabric filters) are to be a viable control option. Nonetheless, economic considerations will dictate that operators hold exhaust gas rates to the minimum compatible with their systems. Both capital and operating costs of control equipment are significant and are proportional to the gas volume handled.

The proposed standard will permit industry to utilize either the open or closed hood for future installations, even though the closed hood provides better air pollution control. The decision to propose this less stringent standard was made only after intensive investigation into the consequences of a standard that would require the closed-hood system on all new steel facilities. Several of these consequences are considered in the following paragraphs.

Manganese is used in all steel manufactured by the BOPF process to improve the fluidity of slag, which reduces splashing and permits increased production rates. Those BOPF's controlled by closed hoods, however, require higher manganese levels. The closed hood has minimum clearnace between the hood, furnace, and removable oxygen lance; and slag that splashes on the lance or the hood-furnace juncture and solidifies will halt production. A requirement that would necessitate increased use of manganese, a strategic raw material essential to the national defense but available within the continental United States in only limited quantities, would be undesirable.

If the closed-hood system were used on all new steel production facilities in the United States, the nation's capability to recycle scrap steel would diminish. Contamination in poor (dirty) grades of scrap causes excessive splashing, which the closed hood cannot tolerate. Furthermore, low-grade scrap contains appreciable grease, paint, and other contaminants. Some of these materials are burned with the carbon monoxide in flares or boilers; however, a portion of the hydrocarbon emissions escapes from the closed hood to become either an air or water pollution problem.

The closed-hood system tested by EPA is of Japanese design and patent. A single U.S. company has been licensed to market the system. Although other systems are available, none was tested and all are of foreign design. The implication of having a foreign supplier and the associated adverse economic effects for the United States were considered.

Routine maintenance of the closed-hood system is far more expensive than that for the open-hood system. Since the closed system is designed to prevent intrusion of dilution air, even simple repairs can become complex and time consuming, often requiring arc-cutting and rewelding of connections that in the open-hood system are merely bolted together.

In a facility where an open-hood system is used, the capital cost for installation of a third furnace controlled by a closed-hood system is several million dollars more than would otherwise be required. Thirty percent of the existing BOPF shops were designed to accommodate a third furnace at some future date when steel demand would justify the investment. A new open hood can normally be manifolded to the existing control device. A closed-hood installation, however, would require a hood, ducting fans, and new control equipment at a premium of \$7 million to \$8 million. Some steel facilities that cannot physically accommodate the high vertical profile required by the retractable closed-hood system would also need building modifications that could cost up to \$30 million. The proposed standard, which will allow the existing control device to be improved to service the third furnace, will result in a reduction of emissions from the older vessels even though they are not subject to the standard.

ENVIRONMENTAL IMPACT OF PROPOSED STANDARDS

Most new units are expected to utilize scrubbers to meet the standard. In typical installations, including all three scrubbing systems tested during the EPA development program, water is recirculated. Two to 10 percent purge may be necessary (40 to 200 gal/min). This purge can be treated in the plant water treatment facilities with existing techniques. Guidelines for water effluents from steel plants are currently under preparation.

At the present time, the high zinc content of the collected dust prevents it from being used as blast furnace charge. It is possible that technology may be developed to enable the dust to be recycled, but at the present time it is landfilled. The material may be in the form of sludge or dust, or it may be pelletized. Landfill sites are usually segregated and mapped for possible future reclamation.

Contamination of ground water by BOPF dust disposal sites has not been identified as a problem. The dust is primarily iron and zinc oxide and calcium fluoride precipitated from the scrubber solution through lime addition. None of these materials has significant solubility in water.

ECONOMIC IMPACT OF PROPOSED STANDARDS

At the end of 1971, there were 36 basic oxygen steel furnace facilities in the United States, owned by 19 different companies. Of a total of 120 million tons of new steel produced that year, these facilities accounted for 64 million tons. Only three of the major integrated iron and steel firms do not utilize the basic oxygen furnace steel facilities.

It has been estimated that approximately 8 million tons of additional capacity will come on-stream between 1974 and 1977. This projection is based on two factors: (1) an expected growth rate of 4.5 percent in raw steel production by the BOPF process and (2) a recovery from the 1971 production-to-capacity ratio of 86 percent to the historic ratio of 92 percent. At present, it is not known how many new facilities will be constructed or how many existing two-vessel facilities will add a third vessel with an open-hood control device.

Three types of control systems can meet the proposed regulations: (1) open hood with scrubber, (2) open hood with precipitator, and (3) closed hood with scrubber. Costs of controlling particulate emissions from new two-vessel facilities are shown in Table 8. These costs cover gas-cleaning devices, hood, duct work, cooling towers (for open-hood scrubbers only), fans, pumps, motors, slurry settlers and filters (for scrubbers), and dust-removal and storage equipment (for precipitators).

Many states formulating plans for air quality implementation are developing particulate standards that limit emissions from steel furnaces to 0.03 to 0.05 gr/dscf. These values are fairly close to current industry performance for all BOPF shops. Meeting the new source performance standards would not increase costs over the requirements of the current industry practice of installing electrostatic precipitators at a new plant. Employing an open-hood scrubber to meet the performance standards at a new plant would increase costs about \$0.10/ton more in comparison with current industry practice in BOPF shops using such control devices. The difference is due to increased power consumption. This cost penalty is negligible compared with a price of \$220/ton of finished steel products for a typical mill product mix.

Plants expanding from two- to three-vessel facilities may be required to incorporate increased cleaning capability into their operations, either with (1) larger fans and bigger motors (including cooling towers for those facilities that do not have them) for scrubbers or (2) additional cleaning sections in precipitation systems. It is expected that an individual shop with two 200-ton vessels may spend up to \$1 million to upgrade the existing control equipment to meet the proposed performance standards covering the third vessel. It seems that this same investment may be required to comply with State regulations as proposed in the implementation plans, especially where expansion of facilities is concerned.

**Table 8. CONTROL COSTS OF MEETING PERFORMANCE STANDARD
(0.022 gr/dscf) FOR TYPICAL NEW TWO-VESSEL BASIC
OXYGEN PROCESS FURNACES^a**

Plant size, tons/melt	Required control equipment	Control investment, \$	Annual cost, \$/yr	Annual cost per unit of production, \$/ton
140	Open hood, scrubber	5,700,000	1,950,000	1.52
	Open hood, ESP ^b	5,900,000	1,500,000	1.17
	Closed hood, scrubber	6,800,000	2,140,000	1.67
250	Open hood, scrubber	7,400,000	2,750,000	1.20
	Open hood, ESP	8,000,000	2,000,000	0.89
	Closed hood, scrubber	8,400,000	2,800,000	1.22

^aMajor assumptions: (1) production of 140 tons/melt = 2,300,000 tons/yr; (2) 18-year straight-line depreciation.

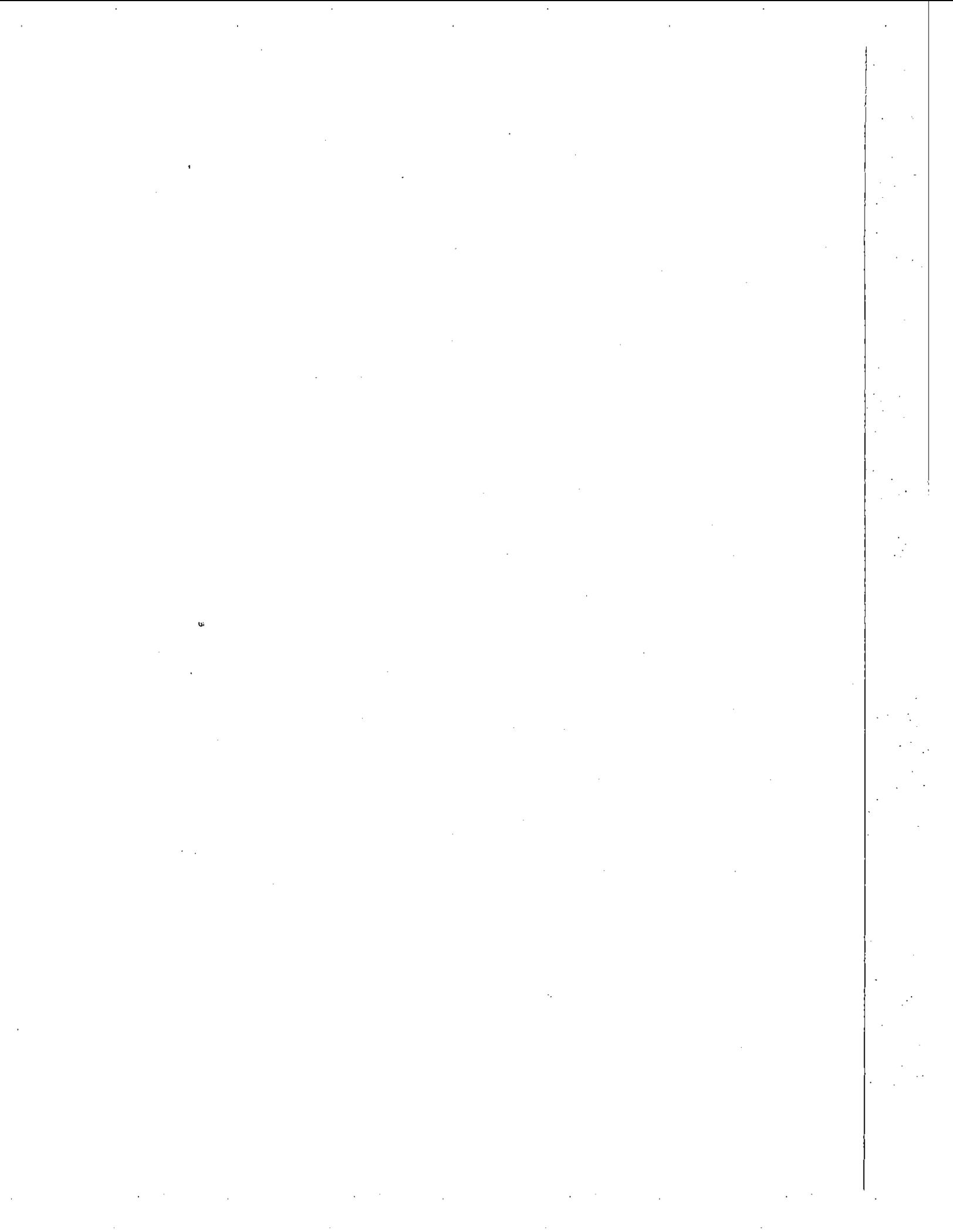
^bESP-electrostatic precipitator.

The standard should not impede conversion of existing open hearth furnaces to basic oxygen steel production. The \$1 million cited above for upgrading controls amounts to 5 percent of the total investment required to add a third vessel to an existing facility, and open hearth furnaces will likely require comparable control investment to comply with a State implementation plan.

This standard should not prove a deterrent to growth in raw steel production nor to conversion of open hearth facilities. With such minimal cost penalties, profit margins should not be affected by the standard.

REFERENCES FOR TECHNICAL REPORT NO. 12

1. A Systems Analysis Study of the Integrated Iron and Steel Industry. Battelle Memorial Institute. Columbus, Ohio. Contract No. PH 22-68-65. May 1969.
2. Iron and Steel Industry. Environmental Engineering Incorporated and Herrick Associates. Gainesville, Fla. CPA 70-142, Task O, No. 2. March 1971.



TECHNICAL REPORT NO. 13 - SEWAGE TREATMENT PLANTS

SUMMARY OF PROPOSED STANDARDS

Standards of performance being proposed for municipal sewage treatment plants would limit emission of particulate matter (including visible emissions) from new incinerators used to burn sludge generated in the treatment plant. These standards would apply to all sewage treatment plants that incinerate sludge from primary or secondary treatment. For plants processing industrial wastewaters, further restriction might be required to prevent the release of specific metals, toxic, organics, or radioactive substances.

The proposed standards would limit particulate emissions to the atmosphere as follows:

1. No more than 70 mg/ Nm^3 (undiluted), or 0.031 gr/dscf.
2. No more than 10 percent opacity.

The proposed visible emission standard is compatible with the mass emission limit; if particulate emissions are below 70 mg/ Nm^3 , visible emissions will be less than 10 percent opacity.

EMISSIONS FROM SLUDGE INCINERATORS

Sludge incinerators (Figures 27 and 28) differ from most other types of incinerators, primarily in that the refuse does not supply enough heat to sustain combustion. Further, there is less emphasis on retaining ash in the incinerator and much of it is discharged in stack gases. In one type of incinerator, the fluidized bed reactor, all of the ash is carried out with the gases. Particulate emissions into the atmosphere are almost entirely a function of the scrubber efficiency and are only minimally affected by incinerator conditions. All sludge incinerators in the United States are equipped with scrubbers of varying efficiency; the scrubbers range from simple bubble-through units to venturi scrubbers with pressure drops of up to 18 inches of water.

Available data indicate that, on the average, uncontrolled multiple-hearth incinerator gases contain about 0.9 gr/dscf of particulate matter. Uncontrolled fluid bed reactor gases contain about 8.0 gr/dscf. For average municipal sewage sludge, these values correspond to about 23 lb/hr in a multiple-hearth unit and about 205 lb/hr in a fluid bed unit. Particulate collection efficiencies of 96.6 to 99.6 percent will be required to meet the standard, based on the above uncontrolled emission rate. Emissions will be on the order of 1.0 lb/hr.

Existing State or local regulations tend to regulate sludge incinerator emissions through incinerator codes or process weight regulations. The most stringent State or local limit, 0.03 gr/dscf, is based on a test method that is different from the reference method in that it includes impingers.¹ Many State and local standards are corrected to a reference base of 12 percent carbon dioxide or 6 percent oxygen. Corrections to carbon dioxide or oxygen baselines are not directly related to the sludge incinerator rate because of the high percentage of auxiliary fuel required. In some regulations, the carbon dioxide from fuel burning is subtracted from the total in determinations of compliance.

For a typical incinerator with a rated dry solids charging rate of 0.5 ton/hr at a gas flow rate of 3000 dscfm, the proposed standard would allow the incinerator to emit 0.8 lb/hr of particulate matter. The reference process weight regulation (Table 1) would limit emissions to 6.3 lb/hr, based on a charging rate of wet sludge (80 percent water) of 5000 lb/hr. Dry solids charging rates for new incinerators will range from 0.5 to 4.0 tons/hr, with gas flow rates of 1,000 to 20,000 dscfm.

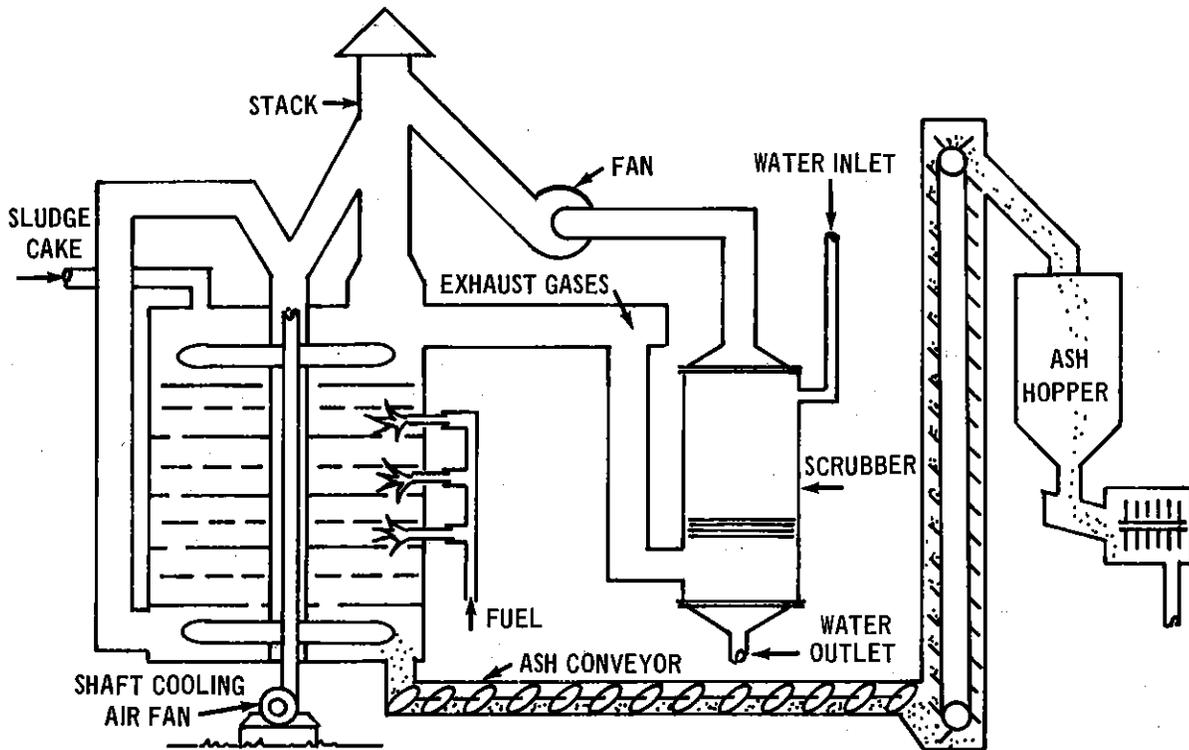


Figure 27. Controlled multiple-hearth furnace, scrubber.

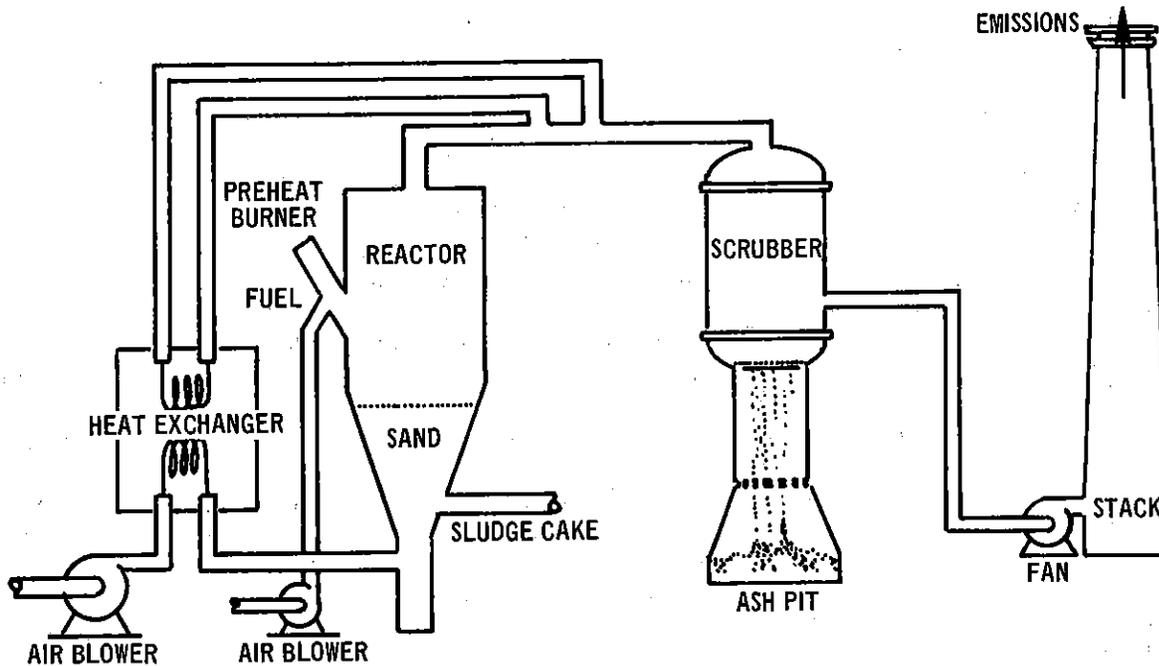


Figure 28. Controlled fluidized bed reactor, scrubber.

RATIONALE FOR PROPOSED STANDARDS

Preliminary investigations revealed the location of 30 reportedly well controlled sewage sludge incinerators. These plants were visited, and information was obtained on the process and control equipment. At 15 of the plants, visible emissions were observed to be less than 10 percent opacity.

Determination was made as to the feasibility of stack testing in each case. Stack tests were conducted at five locations, including three multiple-hearth incinerators and two fluid bed reactors. Four incinerators tested were controlled by impingement-type scrubbers, and one by a venturi scrubber. Pressure drops across the scrubbers range from 2.5 to 18 inches of water.

Of the incinerators tested, one fluid bed reactor and one multiple-hearth incinerator showed particulate emissions at or below the proposed standard (Figure 29). Particulate emissions averaged 0.010 and 0.030 gr/dscf, respectively. A previous test by a local control agency² using the reference method on the fluid bed reactor (Figure 29) indicated average emissions of 0.009 gr/dscf. The other multiple-hearth incinerators tested had erroneously low exit particulate concentrations as a result of dilution by shaft cooling air prior to sampling. Estimated undiluted exit concentrations (Figure 29) are 0.050 and 0.055 gr/dscf. Emission from the second fluid bed reactor (Figure 29) averaged 0.060 gr/dscf.

The fluid bed reactor on which the standard is based is controlled by a venturi scrubber with a pressure drop of 18 inches of water. Because of the limited application of this type of control device

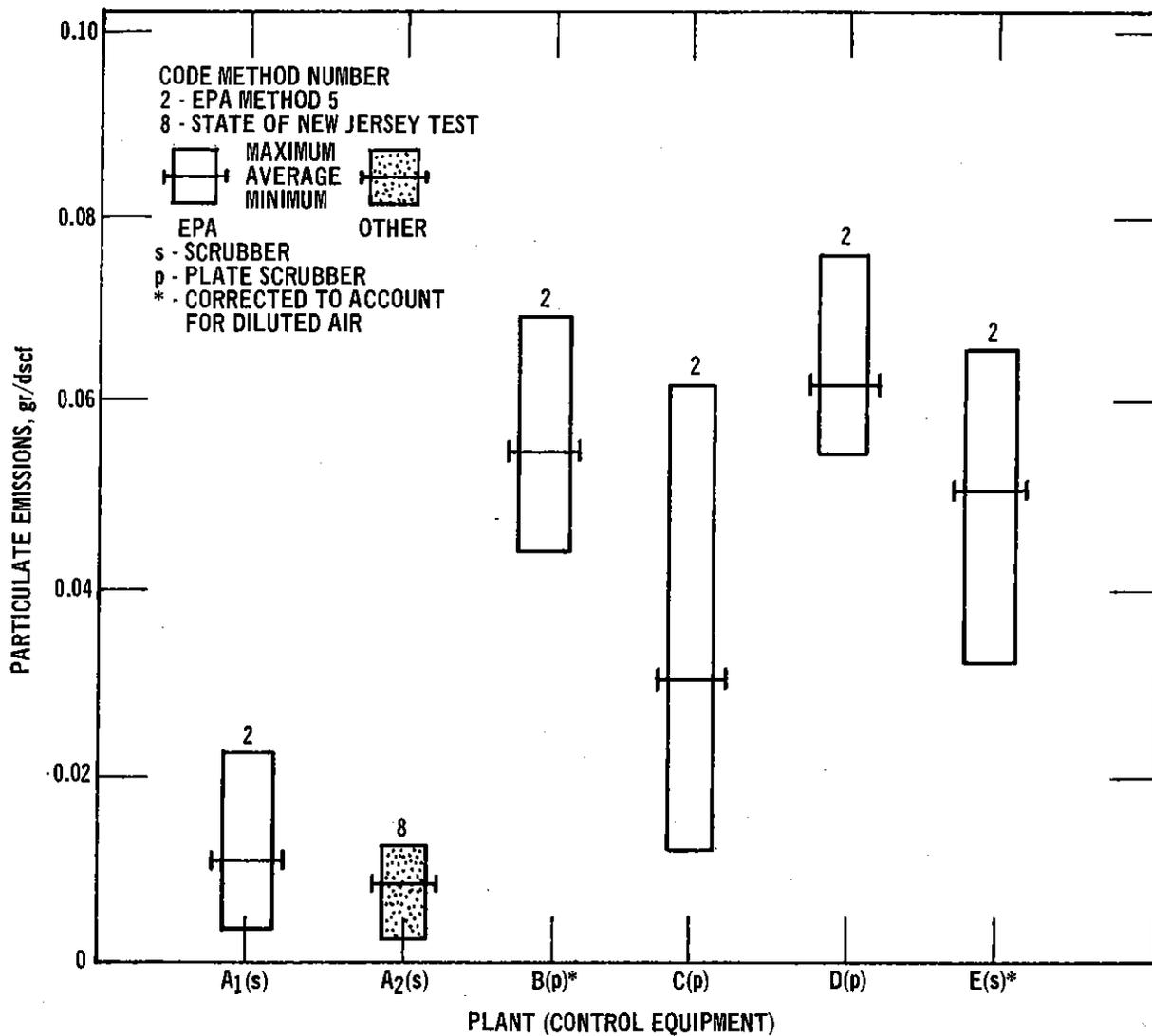


Figure 29. Particulate emissions from sewage treatment plant, sludge incinerator.

on sludge incinerators, the standard has been set at a level somewhat higher than that obtained during the tests of the unit. The remaining installations tested had impingement-type scrubbers, which operated at considerably less pressure drop (2.5 to 6 inches of water). The lower-efficiency impingement scrubbers are adequate to meet opacity and process weight regulations, but do not represent the best control technology. Designers and manufacturers of control equipment will guarantee an outlet concentration of less than 0.030 gr/dscf.

No visible particulate emissions were observed at the five incinerators tested, although moisture-condensation plumes were sometimes present. Ten additional incinerators were observed by EPA engineers to have visible emissions that were within the proposed standard.

ENVIRONMENTAL IMPACT OF PROPOSED STANDARDS

Incineration consumes hydrocarbons and reduces the volume of solid wastes by up to 95 percent. Incinerated sludge is usually acceptable for landfill. If raw sludge is not incinerated, it must be digested or otherwise stabilized to render it acceptable for landfill. Water from the plant is used as the scrubbing medium and recycled to treatment facilities. In no case is new solid or liquid waste created.

For municipal treatment plants, the combination of high-temperature incineration and high-efficiency scrubbing will provide sufficient safeguards against the release of highly toxic air pollutants. Nevertheless, this treatment may not be adequate for industrial installations where there are significant concentrations of mercury or other toxic materials in the sewage. In such instances, other means of sludge handling and disposal should be evaluated.

ECONOMIC IMPACT OF PROPOSED STANDARDS

Over the next few years, it is estimated that 70 new municipal sewage sludge incinerators will be constructed annually in the United States. Factors such as the availability of alternative methods of sludge disposal will have a significant effect on the actual rate of construction.

To estimate the economic impact of the proposed new source performance standards, a model sewage sludge incinerator (multiple-hearth furnace) serving a population of 100,000 persons was utilized. Investment and annual cost to achieve the proposed standard were estimated. To provide a basis for cost comparison, investment and annual costs to comply with a process weight standard for the incinerator were also estimated. Table 9 gives the results of these analyses. Cost information is based upon private communication with manufacturers of sludge incinerators and manufacturers of air pollution control equipment.

Investment costs in air pollution control equipment (low-energy impingement scrubbers) to meet the process weight standard were found to be approximately 4.0 percent of the total installed cost of the sludge incineration facility. The control cost (for a low-energy venturi scrubber) to achieve the proposed new source performance standard represents approximately 4.3 percent of the total installed cost. The increase in installed cost from 4.0 to 4.3 percent is due primarily to the additional fans and motors required for the venturi scrubber.

Annual costs to meet the process weight standard were estimated to be 4 percent of the total annual cost of the sludge incinerator facility. The annual cost of control to comply with the proposed new source standard is estimated to be 6 percent of the total annual cost of the incinerator facility. Increases in the power requirements of the venturi scrubber were found to be a major cause for the increases in annual cost of control. On a per capita basis (population of 100,000 persons), meeting the proposed new source performance standard is estimated to cost \$0.04/year more than a process weight standard of 0.10 gr/scf.

In financing the required investment, municipalities have several alternatives, such as issuing bonds or securing money through pledges of *ad valorem* tax revenues. The proposed new source performance standard is not anticipated to cause additional difficulties.

**Table 9. CONTROL COSTS FOR TYPICAL SEWAGE
SLUDGE INCINERATOR^a**

Plant size, tons/day (cfm)	Emission standard	Required control equipment	Control investment, \$	Annual cost, \$/year	Annual cost per person, \$
10 (10,000)	Performance standard = 0.031 gr/dscf	Low-energy venturi scrubber	60,000	11,700	0.12
	Typical local standard = 0.10 gr/dscf	Low-energy impingement scrubber	55,000	8,400	0.08
100 (17,800)	Performance standard = 0.031 gr/dscf	Low-energy venturi scrubber	132,000	34,200	0.03
	Typical local standard = 0.10 gr/dscf	Low-energy impingement scrubber	120,000	21,100	0.02

^aModel plant assumptions: (1) 10 tons/day—3640 hours of operation per year, 100 tons/day—8736 hours of operation per year; (2) sinking fund depreciation over 12.5 years; and (3) interest at 6 percent.

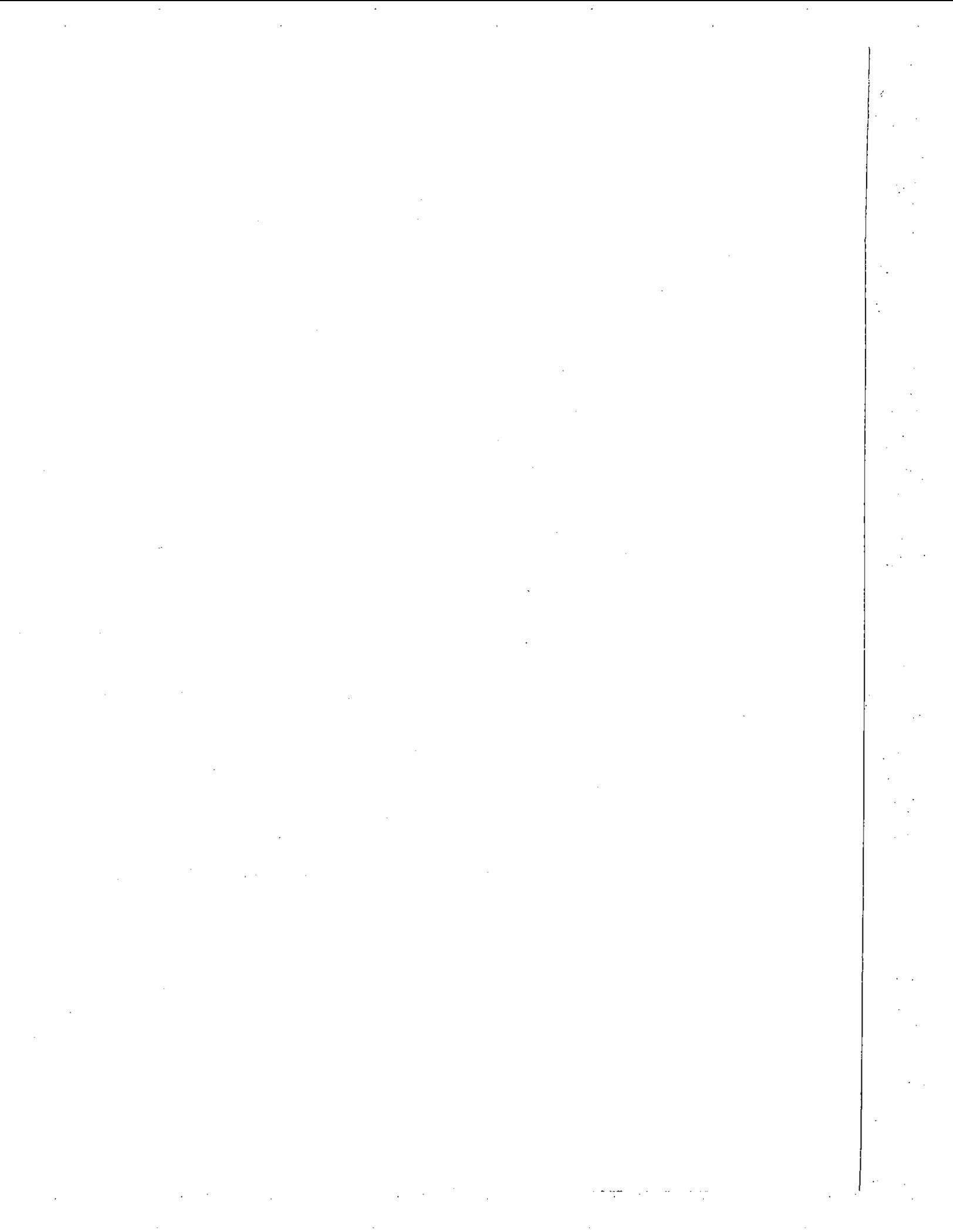
REFERENCES FOR TECHNICAL REPORT NO. 13

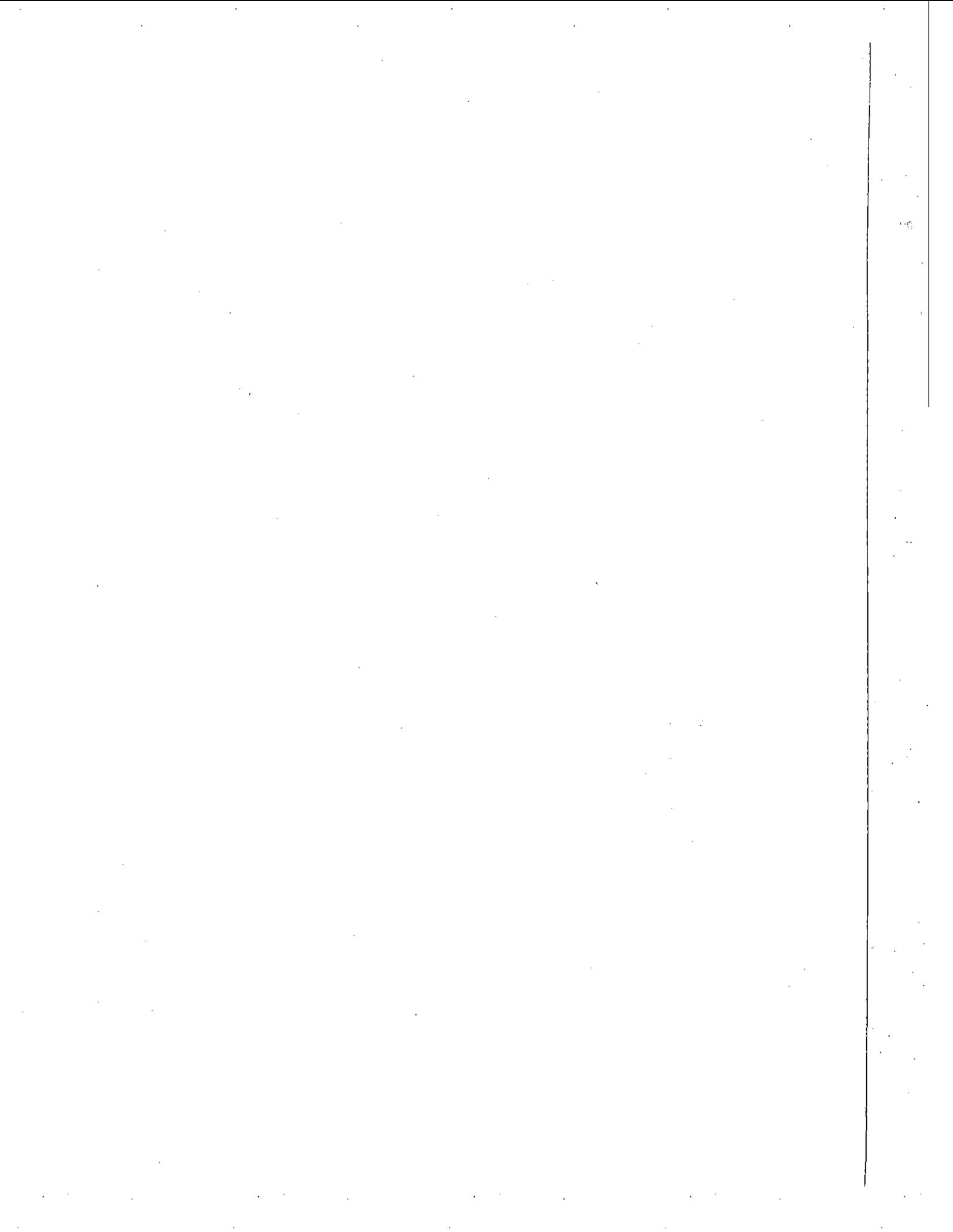
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1. Implementation Plan, Metropolitan Baltimore Intrastate Air Quality Control Region. State of Maryland, Department of Health and Mental Hygiene, Environmental Health Administration. Baltimore, Md. January 28, 1972. (addendum April 4, 1972).
2. Test Report on the N.W. Bergin Sewage Authority Sludge Incinerator for the State of New Jersey. Engineering-Science, Inc. Washington, D.C. Contract No. 68-02-0225. May 1972.

Supplemental References

3. Burd, R.S. A Study of Sludge Handling and Disposal. Ohio Basin Region, Federal Water Pollution Control Administration. Cincinnati, Ohio. FWPCA Publication No. WP-20-4. May 1968.
4. State of the Art Review on Sludge Incineration Practice. Resource Engineering Associates. Wilton, Conn. Contract No. 14-12-499. April 1970.





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Asphalt Concrete Plants
Petroleum Refineries
Storage Vessels
Secondary Lead Smelters and Refineries
Brass or Bronze Ingot Production Plants
Iron and Steel Plants
Sewage Treatment Plants

Volume 2, APPENDIX: SUMMARIES OF TEST DATA



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**Asphalt Concrete Plants
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INTRODUCTION

This appendix presents summaries of source tests cited in the document. The summaries are concerned principally with tests for particulate matter and carbon monoxide, but also describe the facilities, characteristics of exhaust gas streams, and conditions of operation.

For each source category, facilities are identified by the same coding used in the technical reports. For example, Table A-16 summarizes results of the December 1971 test of petroleum refinery catalytic cracking Facility A. These results are also plotted as Bar A₁ in Figure 3 of the Technical Report Number 7. In this case, the bar represents the range of the two valid results. Table A-17 summarizes a second test, A₂, conducted in February 1972 at the same facility.

Most of the tests summarized herein were conducted using the reference test methods of 40 CFR 60. Wherever particulate tests were conducted, additional measurements were made to evaluate materials that condense and collect in impingers as the gases are cooled to 70°F. In the summaries, the "probe and filter catch" is the particulate that relates to the standard and the EPA reference method (Method 5 of 40 CFR 60 as published December 23, 1971). The "total catch" includes the probe and filter catch, plus material collected in the impingers using the particulate method as described in 36 FR 15704, published on August 17, 1971.

Where particulate testing was performed using methods other than those cited above, the method is noted under "Facility" in the discussion and also in the appropriate table. Code test methods are listed in the "Introduction" of the main text.

PETROLEUM REFINERIES
FLUID CATALYTIC CRACKING UNITS

PARTICULATE TEST RESULTS

Stack tests were carried out at four fluid catalytic cracking (FCC) units located in different petroleum refineries. At each installation, carbon monoxide emissions were controlled by the use of an incinerator waste heat boiler (carbon monoxide boiler) and particulate matter by the use of an electrostatic precipitator. Effluent gases were sampled after they had passed through both control devices. At one of the sites tested by EPA, particulate emissions also were measured by refinery personnel. Six other units were tested by a local agency and one by a refinery.

Facilities:

- A. FCC unit of about 55,000-bbl/day capacity, equipped with an electrostatic precipitator followed by a carbon monoxide boiler. Tables A-16 and A-17 summarize results of tests conducted in December 1971 and February 1972. Unit had been onstream about six months and eight months, respectively, following the last major turnaround. Additional source test data were supplied by the refinery and are listed in Table A-21. These were determined using Code Method 6.
- B. FCC unit of about 70,000-bbl/day capacity, equipped with a carbon monoxide boiler followed by an electrostatic precipitator. Unit had been onstream about 10 months following the last

major turnaround at the time of the test. Ammonia was injected into the gas stream ahead of the precipitator as a conditioning agent.

- C. FCC unit of about 65,000-bbl/day capacity, equipped with a carbon monoxide boiler followed by an electrostatic precipitator. Unit had been onstream about 13 months following the last major turnaround. Ammonia was injected into the effluent ahead of the precipitator as a conditioning agent. During the test, a malfunction occurred in the FCC unit.
- D. FCC unit of about 55,000-bbl/day capacity, equipped with an electrostatic precipitator followed by a carbon monoxide boiler. Unit had been onstream about 8 months following the last major turnaround. During the test, an equipment malfunction occurred, invalidating the particulate results.
- E. FCC unit of about 45,000-bbl/day capacity, equipped with an electrostatic precipitator followed by a carbon monoxide boiler. Tested by refinery personnel using Code Method 6 (alundum thimble packed with glass wool followed by a Gelman type A glass fiber filter). Emission data gathered over 18-month period of operation.
- F. FCC unit of about 65,000-bbl/day capacity, equipped with a carbon monoxide boiler followed by an electrostatic precipitator. Tested by local control agency using Code Method 5.

- G. FCC unit of about 30,000-bbl/day capacity, equipped with an electrostatic precipitator followed by a carbon monoxide boiler. Tested by local control agency using Code Method 5.
- H. FCC unit of 45,000-bbl/day capacity, equipped with an electrostatic precipitator followed by a carbon monoxide boiler. Tested by local control agency using Code Method 5.
- I. FCC unit of about 55,000-bbl/day capacity, equipped with an electrostatic precipitator followed by a carbon monoxide boiler. Tested by local control agency using Code Method 5.
- J. FCC unit of about 45,000-bbl/day capacity, equipped with a carbon monoxide boiler followed by an electrostatic precipitator. Tested by local control agency using Code Method 5.
- K. FCC unit of about 55,000-bbl/day capacity, equipped with an electrostatic precipitator followed by a carbon monoxide boiler. Tested by local control agency using Code Method 5.

Table A-16. CATALYTIC CRACKING FACILITY A₁,

SUMMARY OF RESULTS

Run number	1	2	3	Average
Date	12/16/71	12/17/71	12/17/71	
Test time, minutes	120	120	120	120
Stack effluent				
Flow rate, dscfm	185,200	175,600	171,100	177,300
Temperature, °F	645	655	661	653
Water vapor, vol. %	17.9	19.4	19.7	19
CO ₂ , vol. % dry	13	14	14	14
O ₂ , vol. % dry	4	4	4	4
Carbon monoxide emissions, ppm (volume)	14	Nil	Nil	5
Visible emissions, % opacity	10	10	10	10
Particulate emissions				
Probe and filter catch				
gr/dscf	0.1021 ^a	0.0156	0.0114	0.0135
gr/acf	0.0410	0.0061	0.0044	0.0053
lb/hr	161.9 ^a	23.5	16.7	20.1
Total catch				
gr/dscf	0.2866 ^a	0.0246	0.0174	0.0210
gr/acf	0.1150 ^a	0.0096	0.0067	0.0034
lb/hr	455.6	37.0	25.5	31.2

^aExcessive emissions. Test run not considered representative of normal operation, and not included in averages.

Table A-17. CATALYTIC CRACKING FACILITY A₂,
SUMMARY OF RESULTS

Run number	1	2	3	Average
Date	2/8/72	2/9/72	2/10/72	
Test time, minutes	120	120	120	120
Stack effluent				
Flow rate, dscfm	183,800	183,900	184,700	184,100
Temperature, °F	652	666	686	668
Water vapor, vol. %	21.5	20.9	22.0	21.5
CO ₂ , vol. % dry	11.2	12.8	13.2	12.4
O ₂ , vol. % dry	6.4	4.4	4.0	4.9
Carbon monoxide emissions, ppm (volume)	10	9	11	10
Visible emissions, % opacity	10	10	10	10
Particulate emissions				
Probe and filter catch				
gr/dscf	0.0233	0.0202	0.0225	0.0220
gr/acf	0.0088	0.0076	0.0082	0.0082
lb/hr	36.7	31.8	35.6	34.7
Total catch				
gr/dscf	0.0331	0.0272	0.0308	0.0304
gr/acf	0.0125	0.0102	0.0112	0.0113
lb/hr	52.1	42.8	48.7	47.9

Table A-18. CATALYTIC CRACKING FACILITY B,

SUMMARY OF RESULTS

Run number	1	2	3	Average
Date	12/9/71	12/9/71	12/10/71	
Test time, minutes	120	60	60	80
Stack effluent				
Flow rate, dscfm	180,600	183,500	187,000	183,700
Temperature, °F	543	519	547	536
Water vapor, vol. %	14.5	15.5	16.9	15.6
CO ₂ , vol. % dry	13.0	12.0	14.0	13.0
O ₂ , vol. % dry	3.0	3.8	3.0	3.3
Carbon monoxide emissions, Nil ppm (volume)	Nil	Nil	Nil	Nil
Visible emissions, % opacity	30	30	25	30
Particulate emissions				
Probe and filter catch				
gr/dscf	0.0355	0.0364	0.0403	0.0374
gr/acf	0.0161	0.0166	0.0177	0.0168
lb/hr	54.2	56.6	64.1	58.3
Total catch				
gr/dscf	0.1055	0.1320	0.1219	0.1198
gr/acf	0.0480	0.0602	0.0534	0.0539
lb/hr	162.5	207.6	195.5	188.5

Table A-20. CATALYTIC CRACKING FACILITY D,

SUMMARY OF RESULTS

Run number	1	2	3	4	Average
Date	12/14/71	12/15/71	12/16/71	12/16/71	
Test time, minutes	160	240	120	120	160
Stack effluent					
Flow rate, dscfm	196,400	186,400	205,000	195,800	195,900
Temperature, °F	739	732	723	734	732
Water vapor, vol. %	24.7	23.2	20.6	25.9	23.6
CO ₂ , vol. % dry	7.0	7.0	10.2	13.1	9.3
O ₂ , vol. % dry	12.4	12.4	7.4	3.8	9.0
Carbon monoxide emissions, ppm (volume)	Nil	Nil	Nil	6	Nil
Visible emissions, % opacity	15	10	15	15	15

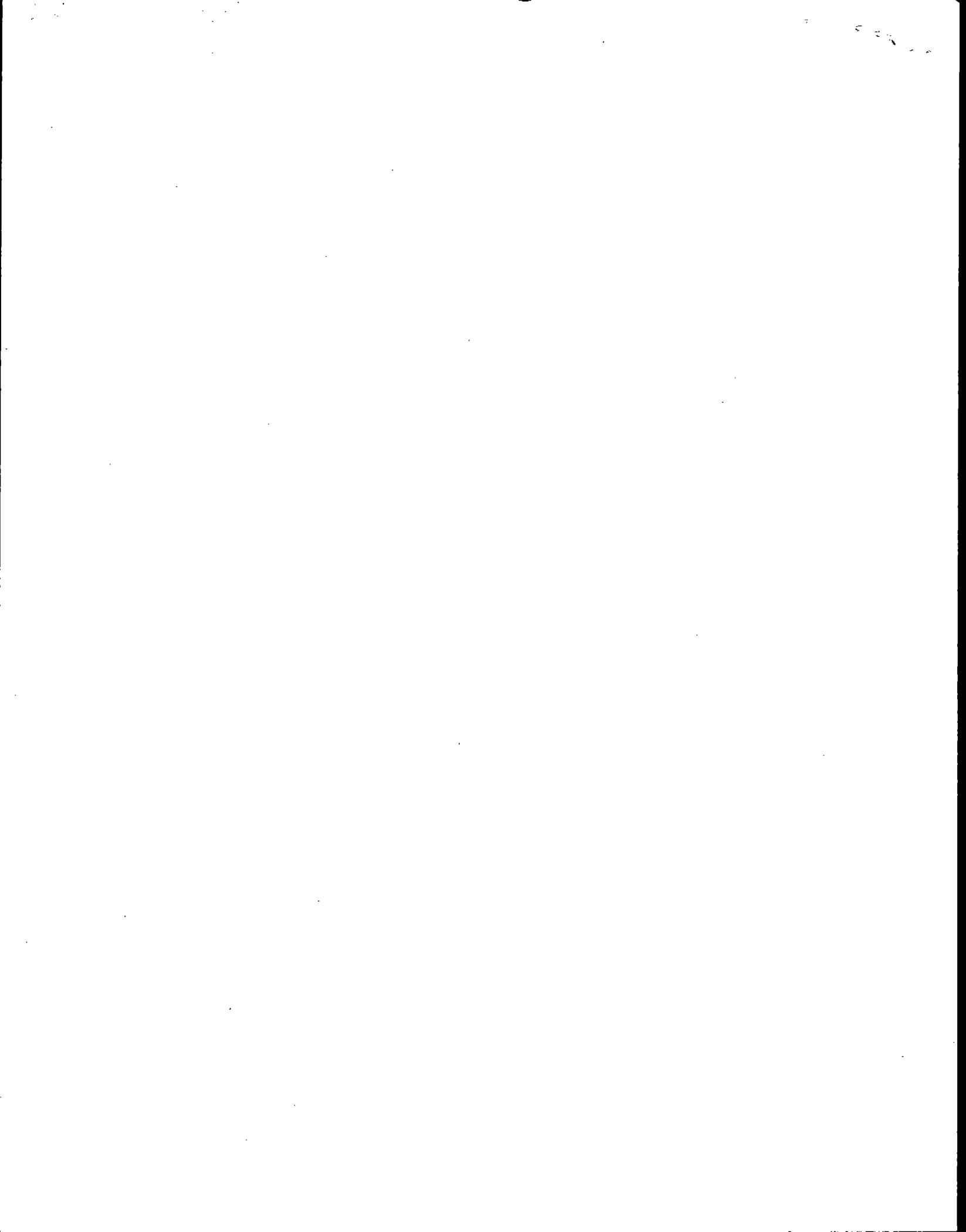
Table A-21. ADDITIONAL PARTICULATE EMISSION DATA
FOR CATALYTIC CRACKING FACILITIES

<u>Facility A₃^a</u>	<u>Stack Effluent flow rate, dscfm</u>	<u>Concentration</u>		<u>Emission rate, lb/hr</u>
		<u>gr/dscf</u>	<u>gr/acf</u>	
Low	166,000	0.010	0.0031	16
High	202,000	0.021	0.0067	34
Average	181,000	0.014	0.0044	22
<u>Facility E^b</u>				
Low	106,000	0.015	0.0066	13.6
High	194,000	0.022	0.0094	28.2
Average	161,000	0.017	0.0076	23.3
<u>Control agency data^c</u>				
Unit F	169,500	0.017	0.0077	24.7
Unit G	233,300	0.018	0.0059	36.0
Unit H	171,600	0.017	0.0062	25.0
Unit I	224,400	0.013	0.0045	25.0
Unit J	198,300	0.020	0.0085	34.0
Unit K	226,900	0.018	0.0061	35.0

^aData covers 7 months operation with two emission tests per month, alundum thimble plus glass fiber filter (Code Method 6).

^bData covers 17 months operation with an emission test about every 2 months, alundum thimble plus glass fiber filter (Code Method 6).

^cData supplied by control agency covering 18 emission tests, Los Angeles County APCD method (Code Method 5). Impingers precede filter.

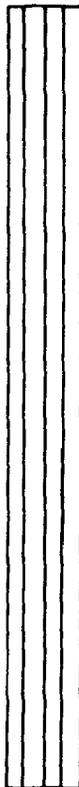


EPA 450/2-74-003

(APTD-1352c)

February 1974

BACKGROUND INFORMATION FOR NEW SOURCE PERFORMANCE STANDARDS:



**Asphalt Concrete Plants
Petroleum Refineries
Storage Vessels
Secondary Lead Smelters and Refineries
Brass or Bronze Ingot Production Plants
Iron and Steel Plants
Sewage Treatment Plants**

Volume 3, PROMULGATED STANDARDS

EPA 450/2
74-003

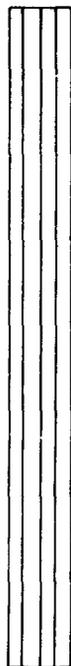
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BACKGROUND INFORMATION FOR NEW SOURCE PERFORMANCE STANDARDS:



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Office of Air and Water Programs
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

February 1974

This report has been reviewed by the Environmental Protection Agency and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the Agency.

Note: The first two volumes published under the title Background Information for Proposed New Source Performance Standards (Volume 1, Main Text and Volume 2, Appendix: Summary of Test Data) were issued under Environmental Protection Agency publication numbers APTD-1352a and APTD-1352b, respectively. Since their publication, EPA has adopted a new numbering system for its documents. Therefore, this document--Volume 3, Promulgated Standards--was issued as publication number EPA-450/2-74-003 (APTD-1532c).

Publication No. EPA-450/2-74-003
(APTD-1352c)

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ABSTRACT

This volume is the third in a series on standards of performance for asphalt concrete plants, petroleum refineries, storage vessels for petroleum liquids, secondary lead smelters, brass and bronze ingot production plants, iron and steel plants, and sewage treatment plants. The first two volumes gave background information and the data base for the proposed standards. This volume presents the promulgated standards and the rationale for any changes that were made, with particular attention to the problems of opacity and dilution air. Major comments received during the period for public comment are discussed where appropriate and are summarized with Agency responses in the appendix. The appendices also contain a list of commentators, new data for asphalt concrete plants, revised economic analyses for asphalt concrete plants and petroleum refineries, and errata for Volumes 1 and 2.

CHAPTER 1. INTRODUCTION

The first two volumes of this document were published in June 1973 under the title Background Information for Proposed New Source Performance Standards (APTD-1352a and APTD-1352b). They provided information on the derivation of the new source performance standards proposed in the Federal Register of June 11, 1973 (38 FR 15406), as amendments to Title 40 CFR Part 60. Standards were proposed for asphalt concrete plants, petroleum refineries, storage vessels, secondary lead smelters, secondary brass and bronze ingot production plants, iron and steel plants, and sewage treatment plants. Volume 1 discussed the sources and types of emissions for each industry, the rationale for the proposed standards, and the environmental and economic impacts of the proposed standards. Volume 2 presented summaries of the source test data upon which the proposed standards were based.

During the public comment period following proposal, EPA received 253 letters from various industry representatives, environmental groups, State and local agencies, and private citizens. Table 1-1 presents a breakdown of these letters by category of affiliation. Over 65 percent of the letters concerned the standard proposed for asphalt concrete plants. In addition to those 253 letters, EPA received 152 letters from 94 Congressmen, of which 142, or over 93 percent, likewise concerned the proposed standard for the asphalt concrete industry. The comments were all carefully evaluated; in many cases, staff engineers telephoned the commentators to clarify their comments or to ask for elaboration on certain points. The comments received were very helpful in pointing out problems with the proposed standards; in some cases, comments addressed to one issue stimulated EPA personnel to rethink other aspects of the standards-setting rationale.

In response to the comments received, and in response to new data received after proposal, some revisions were made to the regulations covering the seven industries cited above. This volume, which accompanies the promulgated regulations, summarizes the promulgated standards and discusses those issues that led to any revisions. Chapter 2, General Considerations, deals with revisions made to the General Provisions, and covers two issues that were common to most of the seven industries. It was evident from the many comments received concerning opacity standards and uses of dilution air that EPA had not clearly stated its position on these subjects. Chapter 2 therefore presents a discussion of the intent of opacity standards and a discussion of the revision in the regulations that covers uses of dilution air.

The promulgated standards are summarized by industry in the following chapters. Any changes in the applicable regulations are discussed, and a rationale for any such changes is presented.

TABLE 1-1. NUMBER OF LETTERS BY AFFILIATION CATEGORY

Category	Number received
State and local air pollution control agencies	12
State and local governmental agencies	6
Federal government	4
Congress	1
Asphalt associations	24
Asphalt companies	141
Asphalt plant equipment manufacturers	1
Petroleum refiners	26
Petroleum product storage companies	7
Petroleum associations	7
Brass and bronze associations	1
Iron and steel plants	2
Consulting firms	12
Control equipment manufacturers	4
Miscellaneous	5
Total	253

Asphalt concrete plant data submitted after proposal are found in Appendix A, and Appendix B is a revised cost analysis for this industry. A revised estimate of the economic impact of the promulgated standard for petroleum refineries is contained in Appendix C. Appendix D presents, by number assigned, the names and affiliations of those who wrote to EPA during the public comment period. A summary of their major comments and EPA's responses to the comments may be seen in Appendix E. Appendices F and G, respectively, contain errata for Volumes 1 and 2 of this document.

CHAPTER 2. GENERAL CONSIDERATIONS

This chapter treats those matters which bear on all, or nearly all, of the new source performance standards.

Subpart A, General Provisions

The regulatory requirements in subpart A of 40 CFR 60 apply to all new source performance standards. These general provisions were not reprinted in their entirety in the Federal Register of June 11, 1973, in which this current group of new source performance standards was proposed; only proposed changes to subpart A are to be found in that issue. To read subpart A in its current entirety, one can refer to the Federal Register of December 23, 1971 (page 24877), which contains the first group of new source performance standards; to the Federal Register of October 15, 1973 (page 28564), which contains the provisions applicable to emissions from sources during periods of startup, shutdown, and malfunction; and to the changes in subpart A promulgated with this group of new source performance standards. The changes to subpart A promulgated with this group of new source standards are discussed below.

1. Two definitions are revised, those for "commenced" and "standards," to clarify their meanings. "Commenced" relates to the definition of "new source" in section 111(a)(2) of the Act and specifies the actions which, if taken by an owner/operator of a source on or after the date on which a new source performance standard is proposed in the Federal Register, cause his source to be subject to the promulgated standard. The change removed one of the previously included actions by an owner/operator, that of entering into a "binding agreement" to construct or modify a source. The phrase "binding agreement" was duplicate terminology for the phrase "contractual obligation" but was being construed incorrectly to apply to other arrangements. Deletion of the first phrase and retention of the second phrase eliminate the problem. "Standard conditions" refers to the temperature and pressure at which all air volumes are to be calculated. The change replaces "standard or normal" with "standard" to avoid the confusion, noted by commentators, created by the duplicate terminology, and also fixes both the temperature and pressure in commonly used metric units to be consistent with the national policy of converting to the metric system.

2. Four definitions are added: "reference method," "equivalent method," "alternative method," and "run," which relate to the performance testing of new sources to determine compliance with regulatory emission limitations. They are added to clarify the terms used in changes to section 60.8, Performance Tests, discussed below.

3. The definition of "particulate matter" is added to the General Provisions and removed from each of the regulations pertinent to new sources to avoid repeating the

definition, and it is changed to include "as measured by an equivalent or alternative method."

4. The section dealing with abbreviations is revised (and reprinted in its entirety) to include new abbreviations, to agree more closely with standard usage, and to alphabetize the listing.

5. The address to which all requests, reports, applications, submittals, and other communications submitted to the Administrator pursuant to any provision of the regulation will be sent is changed from the Office of General Enforcement in Washington, D. C., to the Director of the Enforcement Division in the appropriate regional office of EPA, and the addresses of all ten regional offices are included. The "in triplicate" requirement is changed to "in duplicate."

6. Some of the wording is changed in section 60.6, Review of plans. This section provides for EPA review of plans for construction and modification of sources upon request by owners/operators. The change clarifies the requirement that a separate request must be submitted for each project but not for each facility affected by a regulatory emission limitation. Each affected facility, however, must be identified and appropriately described.

7. The requirement for owners/operators to maintain a file of the data and records required by the new source performance standards is added to General Provisions and removed from each of the regulations for new sources to avoid repetition.

8. Section 60.8, which deals with the performance testing required of new sources to determine compliance with regulatory emission limitations, is amended (1) to require owners/operators to give the Administrator 30 days' instead of 10 days' advance notice of performance testing to provide the Administrator with a better opportunity to have an observer present; (2) to specify the Administrator's authority to permit, in specific cases, the use of minor changes to reference methods, the use of equivalent methods, the use of alternative methods, or the waiver of the requirement for performance testing; and (3) to specify that each performance test shall consist of three runs except where the Administrator approves the use of two runs and that the arithmetic mean of the results shall be used to determine compliance.

9. Section 60.12, Circumvention, is added to make it clear that owners/operators are prohibited from using devices or techniques which conceal rather than control emissions in order to comply with regulatory emission limitations. The proposed new source performance standards each contained provisions intended to prohibit the dilution of gases to conceal emissions. Many commentators pointed out the inequities of these provisions and the vagueness of the language used. Because many processes require the addition of air in various quantities for cooling, for enhancing combustion, and for other useful purposes, it was deemed preferable to state clearly what is prohibited and to use the Administrator's authority to specify the conditions under which compliance testing is carried out in each case to ensure that the prohibited concealment is not used.

Opacity Standards

It is evident from comments received that an inadequate explanation was given for applying both an enforceable opacity standard and an enforceable concentration standard to the same source and that the relationship between the concentration standard and the opacity standard was not clearly presented. Because all but one of the regulations include these dual standards, this subject is dealt with here from the general viewpoint. Specific changes made to the regulations proposed are discussed in each of the chapters devoted to the regulations for specific sources.

A discussion of the major points raised by the comments on the opacity standard follows:

1. Several commentators felt that opacity limits should be only guidelines for determining when to conduct the stack tests needed to determine compliance with concentration/mass standards. Several other commentators expressed the opinion that the opacity standard was more stringent than the concentration/mass standard.

As promulgated, the opacity standards are regulatory requirements, just like the concentration/mass standards. It is not necessary to show that the concentration/mass standard is being violated in order to support enforcement of the opacity standard. Where opacity and concentration/mass standards are applicable to the same source, the opacity standard is not more restrictive than the concentration/mass standard. The concentration/mass standard is established at a level which will result in the design, installation and operation of the best adequately demonstrated system of emission reduction (taking costs into account) for each source. The opacity standard is established at a level which will require proper operation and maintenance of such control systems on a day-to-day basis, but not require the design and installation of a control system more efficient or expensive than that required by the concentration/mass standard.

Opacity standards are a necessary supplement to concentration/mass standards. Opacity standards help ensure that sources and emission control systems continue to be properly maintained and operated so as to comply with concentration/mass standards. Particulate testing by EPA method 5 and most other techniques requires an expenditure of \$3,000 to \$10,000 per test including about 300 man-hours of technical and semi-technical personnel. Furthermore, scheduling and preparation are required such that it is seldom possible to conduct a test with less than 2 weeks notice. Therefore, method 5 particulate tests can be conducted only on an infrequent basis.

If there were no standards other than concentration/mass standards, it would be possible to inadequately operate or maintain pollution control equipment at all times except during periods of performance testing. It takes 2 weeks or longer to schedule a typical stack test. If only small repairs were required, e.g., pump or fan repair or replacement of fabric filter bags, such remedial action could be delayed until shortly

before the test was conducted. For some types of equipment such as scrubbers, the energy input (the pressure drop through the system) could be reduced when stack tests weren't being conducted, and this could result in the release of significantly more particulate matter than normal. Therefore, EPA has required that operators properly maintain air pollution control equipment at all times (40 CFR 60.11(d)) and meet opacity standards at all times except during periods of startup, shutdown, and malfunction (40 CFR 60.11(c)), and during other periods of exemption as specified in individual regulations.

Opacity of emissions is indicative of whether control equipment is properly maintained and operated. However, it is established as an independent enforceable standard, rather than an indicator of maintenance and operating conditions because information concerning the latter is peculiarly within the control of the plant operator. Furthermore, the time and expense required to prove that proper procedures have not been followed are so great that the provisions of 40 CFR 60.11(d) by themselves (without opacity standards) would not provide an economically sensible means of ensuring on a day-to-day basis that emissions of pollutants are within allowable limits. Opacity standards require nothing more than a trained observer and can be performed with no prior notice. Normally, it is not even necessary for the observer to be admitted to the plant to determine properly the opacity of stack emissions. Where observed opacities are within allowable limits, it is not normally necessary for enforcement personnel to enter the plant or contact plant personnel. However, in some cases, including times when opacity standards may not be violated, a full investigation of operating and maintenance conditions will be desirable. Accordingly, EPA has requirements for both opacity limits and proper operating and maintenance procedures.

2. Some commentators suggested that the regulatory opacity limits should be lowered to be consistent with the opacity observed at existing plants; others felt that the opacity limits were too stringent. The regulatory opacity limits are sufficiently close to observed opacity to ensure proper operation and maintenance of control systems on a continuing basis but still allow some room for minor variations from the conditions existing at the time opacity readings were made.

3. There are specified periods during which opacity standards do not apply. Commentators questioned the rationale for these time exemptions as proposed, some pointing out that the exemptions were not justified and some that they were inadequate. Time exemptions further reflect the stated purpose of opacity standards by providing relief from such standards during periods when acceptable systems of emission reduction are judged to be incapable of meeting prescribed opacity limits. Opacity standards do not apply to emissions during periods of startup, shutdown, and malfunction (see Federal Register of October 15, 1973, 38 FR 28564), nor do opacity standards apply during periods judged necessary to permit the observed excess emissions caused by soot-blowing and unstable process conditions. Some confusion resulted from the fact that the startup-shutdown-malfunction regulations were proposed separately (see Federal Register of

May 2, 1973) from the regulations for this group of new sources. Although this was pointed out in the preamble (see Federal Register of June 11, 1973) to this group of new source performance standards, it appears to have escaped the notice of several commentators.

4. Other comments, along with restudy of sources and additional opacity observations, have led to definition of specific time exemptions, where needed, to account for excess emissions resulting from soot-blowing and process variations. These specific actions replace the generalized approach to time exemptions, that of 2 minutes per hour, contained in all but one of the proposed opacity standards. The intent of the 2 minutes was to prevent the opacity standards from being unfairly stringent and reflected an arbitrary selection of a time exemption to serve this purpose. Comments noted that observed opacity and operating conditions did not support this approach. Some pointed out that these exemptions were not warranted; others, that they were inadequate. The cyclical basic oxygen steel-making process, for example, does not operate in hourly cycles and the inappropriateness of 2 minutes per hour in this case would apply to other cyclical processes which exist both in sources now subject to standards of performance and sources for which standards will be developed in the future. The time exemptions now provide for circumstances specific to the sources and, coupled with the startup-shutdown-malfunction provisions and the higher-than-observed opacity limits, provide much better assurance that the opacity standards are not unfairly stringent.

Test Methods

Test Methods 10 and 11 as proposed contained typographical errors in both text and equations that are now corrected. Some wording is changed to clarify meanings and procedures as well.

In Method 10, which is for determination of CO emissions, the term "grab sampling" is changed to "continuous sampling" to prevent confusion. The Orsat analyzer is deleted from the list of analytical equipment because a less complex method of analysis was judged sufficiently sensitive. For clarification, a sentence is added to the section on reagents requiring calibration gases to be certified by the manufacturer. Temperature of the silica gel is changed from 177°C (350°F) to 175°C (347°F) to be consistent with the emphasis on metric units as the primary units. A technique for determining the CO₂ content of the gas has been added to both the continuous and integrated sampling procedures. This technique may be used rather than the technique described in Method 3. Use of the latter technique was required in the proposed Method 10.

Method 11, which is for determination of H₂S emissions, is modified to require five midget impingers rather than the proposed four. The fifth impinger contains hydrogen peroxide to remove sulfur dioxide as an interferent. A paragraph is added specifying the hydrogen peroxide solution to be used, and the procedure description is altered to include procedures specific to the fifth impinger. The term "iodine number flask" is changed to "iodine flask" to prevent confusion.

CHAPTER 3. ASPHALT CONCRETE PLANTS

SUMMARY OF PROMULGATED STANDARDS

The promulgated standards of performance for asphalt concrete plants limit emissions of particulate matter as follows:

1. No more than 90 mg/dscm (0.04 gr/dscf).
2. Less than 20 percent opacity.

Visible emissions caused solely by the presence of uncombined water are not subject to the opacity standard.

The opacity standard, to ensure that emissions of particulate matter are properly collected and vented to a control system, applies to the sources specified in the applicability section of the regulation. The concentration standard applies to emissions of particulate matter from the control system, as evidenced by the test methods required for determining compliance with this standard.

DISCUSSION OF PROMULGATED REGULATION

The proposed standards for asphalt concrete plants clearly generated the most public response. Over four times as many comments were received on these standards as on standards for the other six source categories. In response to the comments and new information received, several revisions were made to the proposed standards. The major differences between the proposed standards and the promulgated standards are:

1. The concentration standard has been changed from no more than 70 mg/Nm³ (0.03 gr/dscf) to no more than 90 mg/dscm (0.04 gr/dscf).
2. The opacity standard has been changed from less than 10 percent except for 2 minutes in any 1 hour to less than 20 percent and the exemption for 2 minutes per hour has been removed.
3. The definition of affected facility has been reworded to clarify the applicability of the standard.

Change in the Concentration Standard

The preamble to the proposed standard urged all interested parties to submit factual data during the comment period to ensure that the standard for asphalt concrete plants would, upon promulgation, be consistent with the requirements of section 111 of the Act. A substantial amount of information on emission tests was submitted in response to this request.

The proposed concentration standard was based on the conclusion that the best systems of emission reduction, considering cost, are well-designed, well-operated, and well-maintained baghouses or venturi scrubbers. The emission test data available at the

time of proposal indicated that such systems could attain an emission level of 70 mg/Nm³, or 0.031 gr/dscf. After considering comments on the proposed standard and new emission test data, a thorough evaluation was made of the achievability of the proposed standard. As a result of this evaluation, the concentration standard was changed to 90 mg/dscm, or 0.04 gr/dscf.

Table 3-1 summarizes all of the emission data received after proposal and includes data for plants equipped with control systems which are considered less efficient than baghouses or venturi scrubbers. The four plants included under "low-energy scrubber-equipped" that had emission levels less than 0.031 gr/dscf were equipped with two or more low-energy scrubbers in series after the primary control device(s). The information received for the 25 plants included under "unknown control device-equipped" did not identify the control equipment used nor the test procedures followed to collect the data; therefore, these data could not be used in the evaluation of the achievability of the proposed standard. Of the test data included under "baghouse- or venturi scrubber-equipped," some were considered invalid because incorrect test procedures were followed or because the control equipment was improperly operated or maintained. The data for the two plants in the category 0.041 to 0.05 gr/dscf, the data for the plant in the category 0.051 to 0.06 gr/dscf, and the data for the plant in the category >0.061 gr/dscf were not considered acceptable for the following reasons:

1. The baghouses on the two plants having emissions in the range 0.041 to 0.05 gr/dscf had a fabric with a permeability greater than that considered to be best demonstrated control technology (considering costs),
2. A torn bag was discovered at the conclusion of the test on the plant having emissions in the range 0.051 to 0.06 gr/dscf, and
3. Improper test procedures that would have affected the accuracy of the test results were used at the plant having emissions greater than 0.06 gr/dscf.

Table 3-2 summarizes the acceptable test data that were received during the comment period and that were taken from plants equipped with either baghouses or venturi scrubbers. As can be seen, 11 plants equipped with baghouses and three equipped with venturi scrubbers had emissions less than 0.031 gr/dscf; however, two baghouse-equipped plants had emissions between 0.031 and 0.04 gr/dscf. Although a limited amount of information was provided on these plants, the test procedures used were reported to comply with those of EPA method 5 and the control equipment was reported to have been properly operated and maintained.

Table 3-1. SUMMARY OF ALL EMISSION TEST DATA SUBMITTED AFTER PROPOSAL

Average outlet concentration, gr/dscf	Number of plants achieving indicated concentration				Total
	Baghouse- or venturi scrubber-equipped	Low-energy scrubber-equipped	Unknown control devices ^a	equipped	
<0.031	14	4 ^b	0	18	
0.032-0.04	2	0	0	2	
0.041-0.05	2 ^c	3	1	6	
0.051-0.06	1 ^c	0	2	3	
>0.06	1 ^c	4	22	27	
Total	20	11	25	56	

^aInadequate information provided on control equipment and plant process variables did not allow for a more definitive classification of this data.

^bPlants were equipped with two or more low-energy scrubbers in series after the primary control device(s).

^cData for these plants were not considered acceptable.

Table 3-2. ACCEPTABLE EMISSION TEST DATA SUBMITTED AFTER PROPOSAL

Average outlet concentration, gr/dscf	Number of plants achieving indicated concentration		
	Baghouse-equipped	Venturi scrubber-equipped	Total
≤0.031	11	3	14
0.032 to 0.04	2	0	2
0.041 to 0.05	0	0	-
0.051 to 0.06	0	0	-
>0.061	0	0	-
Total	13	3	16

In addition to these two plants that had emissions between 0.031 and 0.04 gr/dscf, one of the four plants EPA tested during the development of the proposed standards had average emissions of slightly greater than 0.031 gr/dscf. This tends to indicate that the proposed standard may not be achievable in all cases at all times with a baghouse or with a venturi scrubber.

Appendix A presents all of the data submitted during the public comment period. These data consist of complete or partial stack test reports. This information has been available for public inspection since its receipt by EPA at the Office of Public Affairs, 401 M Street S.W., Washington, D. C., and the Office of Air Quality Planning and Standards, Durham, North Carolina. The average test results for facilities O,Q,R,S,T and U, as presented in Appendix A, are summarized in Table 3-2. Facility P is not included in Table 3-2 because the test data were judged to be inaccurate due to improper test procedures employed. Table 3-2 also includes final test results for 10 other asphalt plants; only the final test results were submitted by the commentators offering these results. Nine of the 12 final test results submitted by the Los Angeles County Air Pollution Control District were considered to be from well-controlled plants and as such were included in Table 3-2; the other three plants were controlled with baghouses equipped with fabrics other than those considered to be required in a best system of emission reduction. A final test result from another asphalt plant was also included in Table 3-2. This test result was considered acceptable because telephone conversations with the plant operator indicated that the plant was tested in conformance with EPA method 5 and the plant was equipped with the best system of emission reduction.

Some of the major comments received from the industry were: (1) the proposed concentration standard of 0.031 gr/dscf cannot be attained either consistently or at all with currently available equipment; (2) the standard should be 0.06 gr/dscf; (3) the standard should allow higher emissions when heavy fuel oil is burned; (4) the type of aggregate used by a plant changes and affects the emissions; (5) EPA

failed to consider the impact of the standard on mobile plants, continuous-mix plants, and drum-mixing plants; and (6) the EPA control cost estimates are too low. Detailed responses to these comments and others are given in Appendix E. When considered as a whole, along with the emission data submitted after proposal (Table 3-2), the comments justify revising the standard. The revision is merely a change in EPA's judgment about what emission limit is achievable using the best systems of emission reduction. The revision is in no way a change in what EPA considers to be the best systems of emission reduction which, taking into account the cost of achieving such reduction, have been adequately demonstrated; these are still considered to be well-designed, -operated, and -maintained baghouses or venturi scrubbers.

Change in the Opacity Standard

The opacity standard covering asphalt concrete plants has been revised to limit visible emissions to less than 20 percent opacity. This revision reflects receipt of new data, reevaluation of the data collected before proposal of the regulation, and the separate promulgation of regulations which exempt from opacity standards any emissions generated during periods of startup, shutdown, or malfunction (see Federal Register of October 15, 1973, 38 FR 28564).

In response to comments received on the proposed opacity standard, additional data were obtained on visible emissions from three well-controlled plants. Two of these three plants were equipped with baghouses, and the third plant was equipped with a venturi scrubber. The opacity of the emissions from these three plants was determined visually by one or two qualified observers. The observations were made for a total of 15 hours at the three plants. No visible emissions were observed from the control equipment on any of the plants. In addition, one plant showed no visible fugitive emissions. Two plants, however, had short periods of visible fugitive emissions that were typically at 10 percent opacity, but in one case up to 45 percent for 1 minute. These fugitive emissions were observed at various points within the two plants. No emission points were common to both plants. For example, while one plant had visible fugitive emissions from the screening system, the other plant did not; i.e., the other plant adequately controlled emissions from that system. Inspection of the two plants having visible fugitive emissions, together with the fact that one plant had no visible fugitive emissions, shows that all of the fugitive emissions observed could have been prevented by proper design, operation, and maintenance of the asphalt plant and its control equipment.

The proposed 2-minute time exemption was not based on observed increases in opacity, but was an arbitrary selection of time intended to prevent uncontrollable short-term emissions from constituting violations. The exemptions now provided by the promulgated startup-shutdown-malfunction regulations cover circumstances specific to the source. The data show that the promulgated opacity limit of less than 20 percent allows minor variations and that there are no operating circumstances or process variables that

would require exemptions in addition to those provided by the startup-shutdown-malfunction regulations.

In the judgment of the Administrator, these data show that the promulgated opacity limit is sufficiently close to observed opacity to ensure proper operation and maintenance of the process and collection equipment, and that the limit, coupled with the exemptions for startups, shutdowns, or malfunctions, constitutes an opacity standard that is not more restrictive than the concentration standard. A general discussion of the intent of opacity standards and the issues involved in setting them is included in Chapter 2 of this volume.

Applicability of the Standard

Section 60.90, applicability and designation of affected facility, is changed from that proposed in order to clarify how and when the standards apply to asphalt concrete plants. The proposed regulation was interpreted by some commentators as requiring existing plants to meet the standards of performance for new sources when equipment was normally replaced or modernized. The proposed regulation specified certain equipment, e.g., transfer and storage systems, as affected facilities, and, because of regulatory language, this could have been interpreted to mean that a new conveyor system installed to replace a worn-out conveyor system on an existing plant was a new source as defined in section 111(a)(2) of the Act. The promulgated regulation specifies the asphalt concrete plant as the affected facility in order to avoid this unwanted interpretation. An existing asphalt concrete plant is subject to the promulgated new source performance standards only if a physical change to the plant or change in the method of operating the plant causes an increase in the amount of air pollutants emitted. Routine maintenance, repair, and replacement; relocation of a portable plant; change of aggregate; and transfer of ownership are not considered modifications which would require an existing plant to comply with the standard.

Revisions to the Cost Estimates

Since the standard was proposed, the cost estimates have been reexamined and additional adjustments have been made. Many of these adjustments were prompted by comments made during the public comment period by the National Asphalt Pavement Association (NAPA) and others. In summary, the capital costs for baghouses have been revised to include: (1) a dust recycling system, (2) an inflation adjustment to 1973 dollars, (3) a change in the value of recycled fines from \$9/ton to \$3.40/ton, and (4) an upward adjustment in the disposal cost for dust collected from the scrubbing systems. These changes increased the estimated cost of the control equipment by approximately 20 percent. The revised estimates appear in Appendix B and represent baghouses with a 6-to-1 air-to-cloth ratio and venturi scrubbers with a pressure drop of 20 inches of water.

When NAPA submitted their public comments on the proposed standard, they also submitted cost estimates from several companies to illustrate that the industry is

experiencing greater cost in the marketplace than had been estimated by EPA. Figure 3-1 demonstrates how EPA's adjusted cost estimates for fabric filters compare to the cost estimates submitted by NAPA. It should be noted that all reported values are below EPA's adjusted costs except two. The line representing EPA's original cost estimates approximately bisects the plot of numbers submitted by NAPA. Those commenting did not submit adequate information to conduct the same analysis for wet scrubbers.

Minor Revisions to the Regulation

The comments pointed out some minor errors and oversights in the information presented in Volumes 1 and 2 of this document. Appropriate revisions were made and are presented in Appendices F and G of this volume.

Minor rewording and reorganization changes that do not affect the opacity or concentration standards are included in the final regulations. To avoid repetition, the provision covering emission-records requirements, the definition of particulate matter, and the provision prohibiting the use of dilution air were removed from individual regulations and incorporated in the General Provisions which are applicable to all sources. The paragraph concerning dilution air has also been revised to clarify misunderstandings evidenced by comments received during the public comment period. Other clarifications include: (1) deletion of "normal" from the particulate concentration standard to avoid confusion between "normal" and "standard," (2) substitution of a more specific statement of conditions under which performance tests will be conducted, and (3) deletion of a confusing and repetitive statement concerning the date upon which the standard becomes applicable. Several other changes, made to clarify EPA's intent, were incorporated in the test methods and procedures. These include a revision of the sampling time specified for performance testing, and inclusion of an exception to the promulgated procedures to make clear EPA's recognition that process variables may interfere with specified sampling conditions. Because these changes in the regulations apply to nearly all of the sources for which standards are promulgated, the rationale for changes is presented in Chapter 2, General Considerations, of this volume.

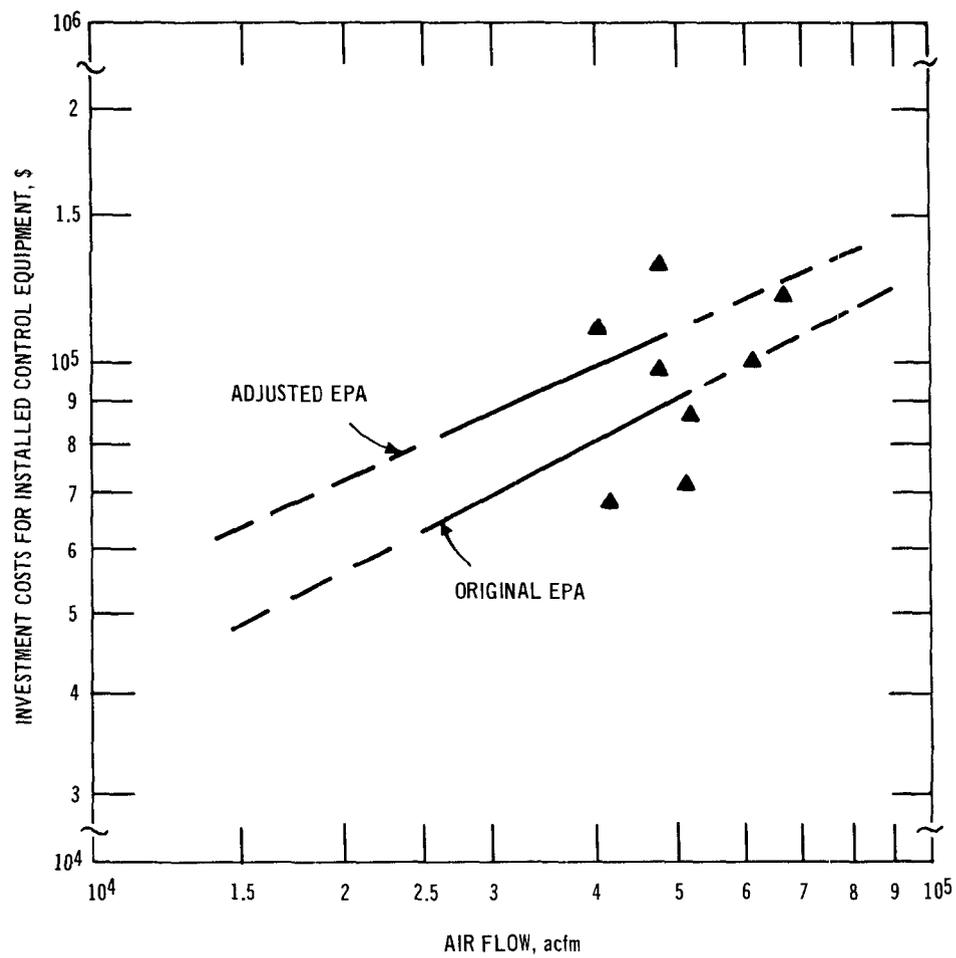


Figure 3-1. Cost comparison between EPA costs and NAPA exhibit costs.

CHAPTER 4. PETROLEUM REFINERIES

SUMMARY OF PROMULGATED STANDARDS

The promulgated standards of performance for petroleum refineries limit emissions of sulfur dioxide from fuel gas combustion systems and limit emissions of particulate matter and carbon monoxide from fluid catalytic cracking unit catalyst regenerators.

Fuel Gas Combustion Systems

The promulgated standard limits emissions of sulfur dioxide to the atmosphere from the combustion of fuel gas containing hydrogen sulfide by specifying that the fuel gas combusted shall contain no more than 230 mg/dscm (0.10 gr/dscf) hydrogen sulfide. A fuel gas combustion system is defined as any equipment such as, but not limited to, process heaters, boilers, and flares used to burn gases. However, the combustion of process upset gases in flares is exempt from the standard.

Although the standard limits sulfur dioxide emissions by specifying a limit on the hydrogen sulfide content of fuel gas combusted, compliance with the standard can be achieved by removing sulfur dioxide from the combustion effluent gases instead of removing hydrogen sulfide from the fuel gas before combustion. In these cases, however, it must be shown to the Administrator's satisfaction that treatment of the combustion gases is as effective in preventing emissions of sulfur dioxide as is removal of hydrogen sulfide from the fuel gas.

Fuel gas is defined as any gas produced by a process unit within a petroleum refinery and combusted as fuel. In addition, any gaseous mixture of natural gas and fuel gas is also considered fuel gas. However, fluid coking unit coke-burner fuel gases and fluid catalytic cracking unit catalyst regenerator fuel gases are exempt from the standard.

Fluid Catalytic Cracking Unit Catalyst Regenerators

The promulgated standards limit the rate of emission of particulate matter to the atmosphere from fluid catalytic cracking unit catalyst regenerators to no more than 1 kilogram per 1,000 kilograms (1 kg/1,000 kg) of coke burn-off in the catalyst regenerator. If, however, a carbon monoxide boiler is employed to burn the carbon monoxide contained in the catalyst regenerator exhaust gases to carbon dioxide, the rate of emission of particulate matter to the atmosphere may increase above this level when liquid or solid auxiliary fuels are burned in the boiler. In these cases, the rate of

emission of particulate matter to the atmosphere permitted by the new source performance standard must be calculated.

To calculate the rate of emission of particulate matter permitted by the standard when liquid or solid auxiliary fuels are burned in a carbon monoxide boiler, the heat input to the boiler that is attributable to these solid or liquid auxiliary fuels must first be determined in millions of calories per hour. This heat input is multiplied by an incremental emission factor of 0.18 gram per million calories, and then divided by the coke burn-off rate in the catalyst regenerator expressed in kilograms per hour. The numerical result is the increase in the rate of emission of particulate matter to the atmosphere permitted by the new source performance standard in kilograms of particulate matter per thousand kilograms of coke burn-off in the catalyst regenerator. This, added to the rate of emission of particulate matter permitted when no liquid or solid auxiliary fuels are burned in the carbon monoxide boiler (1.0 kilogram/1,000 kilograms of coke burn-off in the catalyst regenerator), determines the total rate of emission of particulate matter to the atmosphere from the catalyst regenerator that is permitted by the standard when solid or liquid auxiliary fuels are burned.

The promulgated standards also limit the opacity and carbon monoxide content of the effluent gases released to the atmosphere from the fluid catalytic cracking unit catalyst regenerator. The opacity of the effluent gases must be less than 30 percent, except for 3 minutes in any 1 hour, and the carbon monoxide concentration in the gases discharged to the atmosphere must be 500 ppm (0.050 percent by volume) or less. The 3-minute period in any 1 hour during which the opacity of the gases discharged to the atmosphere may be 30 percent or more is to permit "blowing" of the boiler tubes in the carbon monoxide boiler to remove soot.

Some minor rewording and reorganization that do not change the standards are also included in the promulgated regulations. To avoid repetition, the provision covering emission-records requirements, the definition of particulate matter, and the provision prohibiting the use of dilution air were removed from individual regulations and incorporated in the General Provisions, which are applicable to all sources. The paragraph concerning dilution air has also been revised to clarify misunderstandings evidenced by comments received during the public comment period. Other clarifications include: (1) deletion of "normal" from the particulate concentration standard to avoid confusion between "normal" and "standard," (2) substitution of a more specific statement of conditions under which performance tests will be conducted, and (3) deletion of a confusing and repetitive statement concerning the date upon which the standard becomes applicable. Several other changes, made to clarify EPA's intent, were incorporated in the test methods and procedures. These include a revision of the sampling time specified for performance testing, and inclusion of an exception to the promulgated procedures to make clear EPA's recognition that process variables may interfere with

specified sampling conditions. Because these changes in the regulations apply to nearly all of the sources for which standards are promulgated, the rationale for changes is presented in Chapter 2, General Considerations, of this volume.

DISCUSSION OF PROMULGATED REGULATION

Review and evaluation of the comments received resulted in two changes to the standard proposed for fuel gas combustion devices:

- (1) The combustion of process upset gas in flare systems is exempt from the promulgated standard.
- (2) Hydrogen sulfide in fuel gases combusted in any number of facilities may be monitored at one point if the fuel gases combusted in each facility are of the same composition.

Review and evaluation of the comments received during the public comment period resulted in three major changes to the proposed standards for fluid catalytic cracking unit catalyst regenerators:

- (1) Under the promulgated standards, the opacity of the gases discharged to the atmosphere must be less than 30 percent, except for 3 minutes in any 1 hour. The proposed standard would have limited the opacity of the effluent gases released to the atmosphere to less than 20 percent, except for 3 minutes in any 1 hour.
- (2) The promulgated standards limit the rate of emission of particulate matter to the atmosphere from the catalyst regenerator in kilograms of particulate matter per 1,000 kilograms of coke burn-off in the catalyst regenerator. The proposed standard would have limited the concentration of particulate matter in the gases discharged to the atmosphere.
- (3) The stringency of the standard that limits the rate of emission of particulate matter to the atmosphere has been relaxed by about 25 percent. EPA's original intent was to limit the rate of emission of particulate matter to the atmosphere from fluid catalytic cracking unit catalyst regenerators to about 0.8 kilogram of particulate matter per 1,000 kilograms of coke burn-off in the catalyst regenerator. The promulgated standard, however, limits emissions to 1.0 kilogram per 1,000 kilograms of coke burn-off.

Fuel Gas Combustion Systems

The two changes made to the proposed standard for fuel gas combustion systems do not represent any change in EPA's original intent. It was evident from the comments received, however, that the intent of the regulations was not clear. Therefore, explicit provisions were incorporated into the promulgated standard to exempt the flaring of process upset gases and to permit monitoring at one location of the hydrogen sulfide content of fuel gas combusted in any number of combustion devices.

Flare Systems

Although petroleum refinery flare systems are frequently used to routinely dispose of various low-value process gases produced within a refinery, they are installed

primarily to provide a means for safely disposing of large volumes of process upset gases suddenly and unexpectedly released from various process units. Because the frequency of process upsets and the volumes of gases which must be disposed of are highly unpredictable, it is not feasible to design or operate a gas treating facility that would prevent sulfur dioxide emissions from flare systems in these situations. A facility designed to remove hydrogen sulfide from all process upset gases prior to combustion would have to be designed to handle the immediate release of gases from all process units if each unit experienced the worst possible upset or malfunction at the same time. The costs of such a large gas treatment facility would impose a severe and unreasonable economic burden upon a refinery. Therefore, as noted on page 25 in Volume 1 of this document, the intent is that "The proposed standard does not apply to extraordinary situations, such as emergency gas releases..."

Monitoring of Hydrogen Sulfide

Within large petroleum refineries, groups of process heaters or boilers generally have a common source of fuel gas and each process heater and boiler burns fuel gas of the same composition. It was EPA's original intent to permit monitoring of fuel-gas hydrogen sulfide at one location for combustion sources having a common source of fuel gas. However, the proposed regulations did not specifically state that this was permissible, and, as many commentators pointed out, the regulations could be construed to require monitors on each process heater or boiler. Consequently, provisions are included in the promulgated regulations specifically stating that the use of common-source fuel gas monitors is acceptable.

Exemption of Small Refineries

Many commentators suggested that small petroleum refineries be exempt from the standard for fuel gas combustion systems since compliance with the standard would impose a severe economic penalty on small refineries. It was suggested that refineries of less than 40,000 bbl/day capacity be exempt and that refineries be exempt where the amount of hydrogen sulfide in the fuel gas before combustion was less than 10 tons per day.

Background information considered in proposing the sulfur dioxide standard on fuel gas combustion devices (Volume 1 of this document) included a review of the costs associated with converting hydrogen sulfide to elemental sulfur at small refineries. Based on this review, EPA concluded that the proposed standard would have little or no adverse economic impact on petroleum refineries. In light of the comments received, EPA reexamined this point with particular attention to the small refiner. Because this analysis indicates that refinery growth for both small and large refineries will not be precluded by the proposed new source performance standards for fuel gas combustion, the standard is promulgated with no exemption for small petroleum refineries.

EPA's analysis is presented in Appendix C. The domestic petroleum industry is extremely complex and highly sophisticated. Thus, any analysis of the petroleum refining industry will of necessity be based on a number of simplifying assumptions. Although the assumptions in the economic impact statement appear reasonable, the statement should not be viewed as definitively identifying specific costs; rather it identifies a range of costs and approximate impact points. The analysis examines more than the economic impact of the standard for fuel gas combustion systems. It also examines the combined economic impact of this standard for fuel gas combustion systems, the standards for fluid catalytic cracking units, the water quality effluent guidelines being developed for petroleum refineries, and EPA's regulations requiring the reduction of lead in gasoline. Essentially, the economic impact of "pollution control" is reviewed in light of the petroleum import license-fee program being administered by the Oil and Gas Office of the Department of the Interior (38 FR 9645 and 38 FR 16195).

This program is designed to encourage expansion and construction of U. S. petroleum refining capacity and expansion of U. S. crude oil production by imposing a fee or tariff on imported petroleum products and crude oil. Although this program is currently being phased into practice with the full impact not to be felt until mid-1975, the central feature of the program is to impose a fee of 21¢ per barrel above world price on imported crude oil and a fee of 63¢ per barrel above world price on imported petroleum products such as gasoline, fuel oils, and "unfinished" or intermediate petroleum products.

Under the conditions currently existing in the United States, which are forecast to continue throughout the remainder of this decade and most of the next decade, and with domestic demand for crude oil and petroleum products far outstripping domestic supply and petroleum refining capacity, the import license-fee program will encourage domestic prices of crude oil and petroleum products to increase to world levels plus the fee or tariff. Thus, an incentive of 42¢ per barrel (63¢ per barrel minus 21¢ per barrel) is provided to domestic refiners by this program. In cases where "independent" refiners continue to enjoy a captive supply of domestic crude oil, or where "major" refiners engaged in the exploration and production of domestic crude are successful in supplying their refineries with domestic crude oil, this incentive will approach the full 63¢ per barrel fee imposed on imported petroleum products.

In evaluating the economic impact associated with the new source performance standards on fuel gas combustion and fluid catalytic cracking units, it should be noted that the impact is greater on small refineries than on large refineries. This is also true of the impacts associated with the water quality effluent guidelines being developed and with the EPA regulations requiring the reduction of lead in gasoline. However, this is a natural result of the economics-of-scale associated with large refineries. Since the capacities of domestic petroleum refineries vary from 5,000 bbl/day to 500,000 bbl/day, this factor is of major importance in assessing the economic impact of the standards on small refineries.

Table 4-1 summarizes the average costs associated with the new source performance standards on fuel gas combustion devices and fluid catalytic cracking units for petroleum refineries of various processing capacities. The average costs associated with the envisioned water quality effluent guidelines and the EPA regulations requiring the reduction of lead in gasoline are also summarized.

As shown in Table 4-1, the average costs associated with new source performance standards range from 10¢ per barrel for a 5,000-barrel-per-day refinery to 2¢ per barrel for a 100,000-barrel-per-day refinery. The average costs associated with the envisioned water quality effluent guidelines and the EPA regulations requiring a reduction of the lead in gasoline range from 17¢ and 12¢ per barrel to 3¢ and 2¢ per barrel for a 5,000-barrel-per-day and a 100,000-barrel-per-day refinery, respectively. The total costs associated with "pollution control" are therefore estimated to range from 39¢ per barrel to 7¢ per barrel, respectively, for an average 5,000-barrel-per-day and an average 100,000-barrel-per-day petroleum refinery.

In light of the incentive provided to the domestic petroleum refining industry by the import license-fee program (42¢ to 63¢ per barrel), it appears that the costs of pollution control will not preclude refinery growth for either large or small refineries. Although the costs of pollution control offset to some degree this incentive, pollution control costs would almost completely offset the incentive only for a very small petroleum refinery in the range of 5,000 barrels per day. This could occur if this small refinery were operating in an environment where the incentive only amounted to 42¢ per barrel. If, however, this small refinery were operating in an environment where the incentive approached 63¢ per barrel, the import license-fee program would still provide an incentive of 24¢ per barrel to this small refinery.

The analysis indicates that the incentive provided to the domestic petroleum refining industry by the import license-fee program is greater than the costs of pollution control requirements. The differences in control costs for the small refiner relative to the large refiner will still exist, but with the fee system in operation the small refiner will not be forced into a no-growth situation because of compliance with EPA requirements. Therefore, small refineries are not exempt from the standards.

Fluid Catalytic Cracking Unit Catalyst Regenerators

Change in the Opacity Standard

The standard covering opacity of gases discharged to the atmosphere from fluid

Table 4-1. POLLUTION CONTROL COSTS IMPOSED ON PETROLEUM REFINING

Refinery capacity, bbl/day	Annualized costs, ¢/bbl					Total
	Air pollution regulations		Water pollution regulations	Regulations on lead in gasoline		
	Fuel gas	Catalytic cracking				
5,000	10	- ^a	17	12	39	
10,000	5	2	8	6	21	
50,000	2	1	4	2	9	
100,000	1.5	0.5	3	2	7	

^aPetroleum refinery judged too small to support a fluid catalytic cracking unit.

catalytic cracking units has been revised to limit emissions to less than 30 percent opacity, except for 3 minutes per hour. This revision is based on new data, reevaluation of the data collected before proposal of the regulation, and the separate promulgation of regulations exempting from opacity standards any emissions generated during periods of startup, shutdown, or malfunction (see Federal Register of October 15, 1973, 38 FR 28564). In response to comments received, additional data were obtained on visible emissions from four well-controlled plants. All four of these plants were equipped with electrostatic precipitators. Opacity of the emissions from the fluid catalytic cracking units was determined by one or two qualified observers; observations were made for a total of 18-1/2 hours at the four plants.

Observations were made for 5-1/2 hours at one unit that had emissions below the standard (1 kg/1,000 kg of coke burn-off in the catalyst regenerator). Two sootblows of 3 minutes each at 100 percent opacity were observed; also observed were many short periods of visible emissions that were not sootblows, ranging from 15 seconds to several minutes, at 20 percent opacity or greater. These short periods totaled 30 minutes. Operating and maintenance procedures were checked and discussed with the operator; no normal process variations were found that would cause visible emissions in excess of the promulgated standard at a well-controlled unit.

Observations at the other three units resulted in similar data. Except at one plant that blows soot for 1 hour at night, no sootblows were observed to exceed 30 percent for longer than 3 minutes. This refinery is in the process of changing to a system that would take only 3 minutes per hour.

These data indicate the need for an opacity limit higher than the proposed limit of 20 percent. The data support raising the limit to less than 30 percent and retaining the 3-minute exemption per hour to account for sootblowing. The opacity standard is therefore promulgated at less than 30 percent opacity, except for 3 minutes in any 1 hour.

In the judgment of the Administrator, these data show that the promulgated opacity limit of less than 30 percent opacity except for 3 minutes in any 1 hour is sufficiently close to observed opacity to ensure proper operation and maintenance of the process and collection equipment, and that the limit, coupled with the exemptions for startups, shutdowns, and malfunctions, constitutes an opacity standard that is not more restrictive than the process weight standard. A general discussion of the intent of opacity standards and the issues involved in setting them is included in Chapter 2 of this volume.

Type of Standard

Several commentators pointed out that the volume of gases discharged to the atmosphere from fluid catalytic cracking unit catalyst regenerators can vary significantly,

depending upon the overall system used to control emissions of particulate matter and carbon monoxide. Consequently, the degree of control required to meet the proposed concentration standard for particulate matter depends upon the overall emission control system employed. For example, two identical catalyst regenerators might limit the concentration of particulate matter in the gases discharged to the atmosphere to the same level, but different emission control systems might be employed and one catalyst regenerator would then be permitted by the proposed standard to emit significantly more particulate matter into the atmosphere than would the other. It was concluded, therefore, that an emission standard should be developed which would require the same degree of control of emissions from catalyst regenerators, irrespective of the emission control system employed.

The various emission control systems which can be used to control emissions of particulate matter and carbon monoxide from fluid catalytic cracking unit catalyst regenerators are shown in Figure 4-1. Each of these systems is currently being used within the petroleum refining industry.

System 1 controls emissions of carbon monoxide by complete combustion of the coke from the catalyst surface within the catalyst regenerator. This is a recent development in the technology of fluid catalytic cracking and most fluid catalytic cracking unit catalyst regenerators remove the coke from the catalyst surface under conditions which result in incomplete combustion of the coke. The exhaust gases from the regenerator, containing little or no carbon monoxide, are then cooled from 1,300-1,500°F to 500-600°F, passed through an electrostatic precipitator to remove particulate matter, and discharged to the atmosphere.

In control system 2, the effluent gases from the regenerator contain from 10 to 12 percent carbon monoxide and are incinerated in a carbon monoxide boiler to generate steam. Although the effluent gases from the regenerator are at a high temperature (1,000 to 1,200°F), additional air and auxiliary fuel must be provided to ensure the complete combustion of carbon monoxide to carbon dioxide. Following the carbon monoxide boiler, the gases pass through an electrostatic precipitator and are discharged to the atmosphere.

Control system 3 is the same as control system 2, except that the precipitator is located ahead of the carbon monoxide boiler. The effluent gases from the regenerator are cooled from 1,000-1,200°F to 500-600°F, passed through an electrostatic precipitator, combusted in the carbon monoxide boiler, and discharged to the atmosphere. Because the temperature of the gases entering the carbon monoxide boiler is in the range of 500 to 600°F rather than 1,000 to 1,200°F as in control system 2, more auxiliary fuel and air must be provided to ensure combustion of carbon monoxide to carbon dioxide.

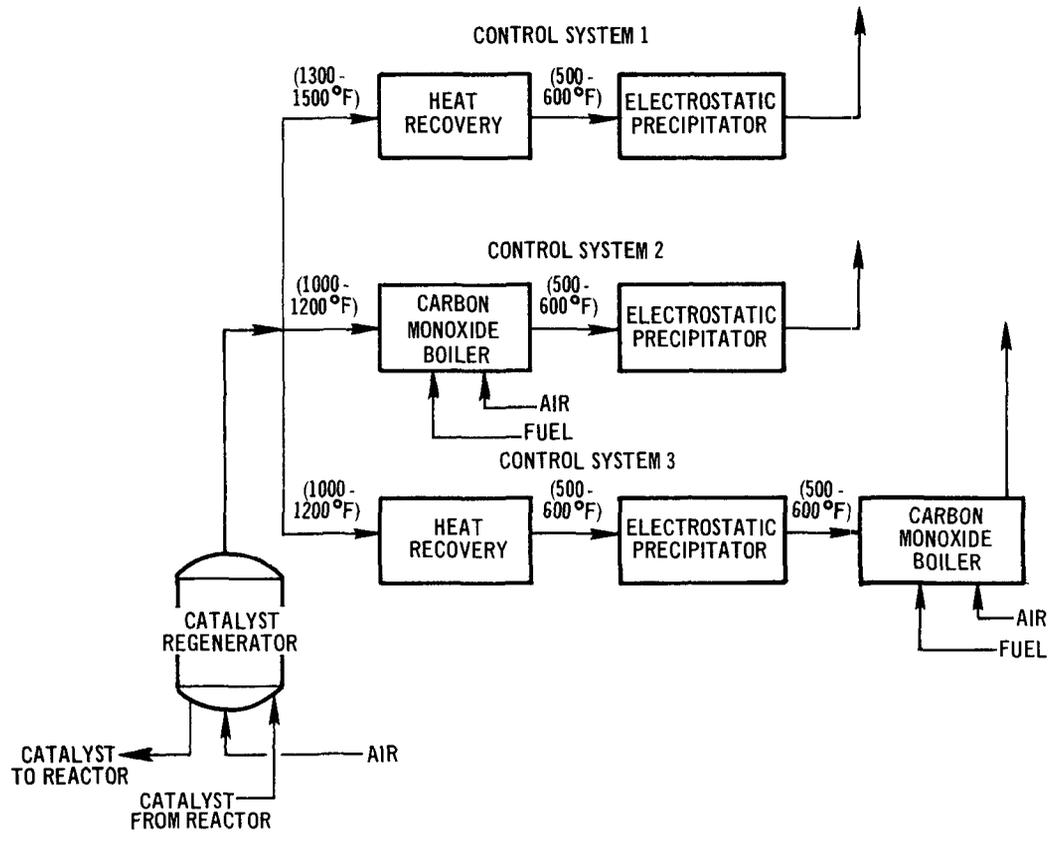


Figure 4-1. Fluid catalytic cracking unit catalyst regenerator emission control systems.

If "minimum" carbon monoxide boilers are utilized in control systems 2 and 3, the ratio of the volumes of gases discharged to the atmosphere from control systems 1, 2, and 3 is approximately 1.0:1.05:1.30. This variation in the gas volumes is due solely to the air and auxiliary fuel which must be provided to the carbon monoxide boilers in control systems 2 and 3 to ensure complete combustion of carbon monoxide.

"Minimum" carbon monoxide boilers, as the term implies, use only the minimum amounts of air and auxiliary fuel necessary to ensure combustion of carbon monoxide. In control system 2, minimum carbon monoxide boilers are normally employed because boilers using more than the minimum amounts increase the volume of gases to be treated in the electrostatic precipitators; this requires a larger precipitator and increases costs. In control system 3, however, there are no economic penalties associated with increasing the volume of gases by burning more than the minimum amounts of air and auxiliary fuel in the boiler and, in many cases, minimum carbon monoxide boilers are not used in this type of control system. This was confirmed in a limited survey, made by EPA, which shows that the ratio of the volumes of gases discharged to the atmosphere from control systems 1, 2, and 3 are frequently about 1.0:1.05:1.50 rather than 1.0:1.05:1.30. Furthermore, contacts with the major vendors that supply carbon monoxide boilers to the petroleum refining industry indicated that there were no technical limitations to prevent this ratio for control system 3 from increasing significantly above 1.50.

As a result, it was concluded by EPA that the standard limiting emissions of particulate matter from fluid catalytic cracking unit catalyst regenerators should be revised to be independent of the volume of gases discharged to the atmosphere. Frequently, a concentration emission standard can be corrected to a reference basis to compensate for excess or dilution air introduced into effluent gases. For example, the new source performance standard promulgated for municipal incinerators references all determinations of effluent gas volumes to 12 percent carbon dioxide. In the case of fluid catalytic cracking unit catalyst regenerators, however, a carbon dioxide reference basis is not adequate because the variation in volume of the effluent gases is not due to excess or dilution air, but is due to combustion of auxiliary fuel in the carbon monoxide boiler. Other methods of adjusting the volume of gases discharged to the atmosphere to a common reference basis were also found to be inadequate. Consequently, the concept of writing an emission standard limiting the concentration of particulate matter in the gases discharged to the atmosphere was abandoned.

A review of various means of expressing an emission standard to limit particulate emissions from fluid catalytic cracking unit catalyst regenerators was undertaken by EPA. The major goal was to develop an emission standard that required the same degree of control of emissions from catalyst regenerators of the same size or capacity. Various options considered were a standard requiring a certain control efficiency, a process weight standard, or a standard in terms of emissions per unit of size or capacity.

The data needed to develop an emission standard requiring a certain control efficiency were not available. The data to develop a process weight standard were available. However, the determination of the circulation rate between the fluid catalytic cracking unit reactor and the catalyst regenerator requires either a sophisticated laboratory analysis to determine the amount of coke on both the fresh catalyst from the catalyst regenerator and the deactivated catalyst from the reactor, or the development of a material and energy balance around the catalyst regenerator. In either case, the determination of the catalyst circulation rate is difficult.

The data for developing an emission standard to relate emissions to size or capacity in terms of coke burn-off rate in the catalyst regenerator were also available. Although the determination of coke burn-off rate does require some calculations, they are not complex. Consequently, an emission standard relating particulate emissions to coke burn-off rate in the catalyst regenerator has been developed and promulgated. Under the promulgated standard, the degree of control efficiency required is independent of the volume of gases discharged to the atmosphere, and emissions are limited to the same level for identical catalyst regenerators.

Level of the Emission Standard

A number of comments were received concerning the level of the proposed emission standard limiting the concentration of particulate matter in the gases discharged to the atmosphere from fluid catalytic cracking unit catalyst regenerators. Before discussing these comments, however, it is pertinent to review some aspects of the operation of fluid catalytic cracking units that were not discussed in Volume 1 of this document.

Quite literally, fluid catalytic cracking units are the heart of most moderate- and high-conversion refineries. They constitute one of the major processes for converting heavy, high molecular weight fractions of crude oil which are of low value into lighter, more valuable products such as gasoline. As a result, fluid catalytic cracking units operate continuously, with run lengths between major shutdowns or turnarounds in the range of 1 to 2 years. Turnarounds are major projects and may require 3 to 6 weeks; during turnarounds the fluid catalytic cracking unit is completely overhauled and renovated with repair crews working 24 hours per day, 7 days a week, until the unit is back into operation.

Essentially, the particulate matter emitted to the atmosphere from the catalyst regenerator in a fluid catalytic cracking unit is catalyst dust which is entrained in the effluent gases from the regenerator. To minimize this loss of catalyst, there are two stages of internal cyclones incorporated in the regenerator vessel to remove catalyst from the effluent gases and to recycle it to the fluidized bed of catalyst maintained in

the regenerator. These cyclones are shown in Figures 4 and 5 on page 18 of Volume 1 of this document. Because these internal cyclones operate under severe conditions, their collection efficiencies deteriorate with time and the concentrations of catalyst dust in the gases discharged from catalyst regenerators increase. If an electrostatic precipitator is employed to control emissions, the load on this precipitator increases as a result of this deterioration.

Precipitators function solely as air pollution control devices. The catalyst dust recovered by precipitators is normally not returned to the catalyst regenerator since it would most likely be reentrained in the effluent gases and would merely increase the load on the precipitator. Thus, even with a precipitator, the loss of catalyst from the catalyst regenerator increases as the collection efficiency of the internal cyclones deteriorates. Normally, after 1 to 2 years of continuous operation, the loss of catalyst makes continued operation of the fluid catalytic cracking unit uneconomical and the unit is shut down.

Consequently, fluid catalytic cracking unit catalyst regenerators are one of the few types of process equipment which exhibit, with time, control equipment deterioration that cannot be prevented by routine maintenance or proper operating practices. The repair or replacement of the internal cyclones within the catalyst regenerator can only be performed when the fluid catalytic unit is shut down for an equipment turnaround.

Most of the comments received on the proposed emission standard concerned equipment deterioration. Although most of the commentators felt that the emission standard could be achieved on a newly renovated catalyst regenerator following a turnaround of the fluid catalytic cracking unit, they did not feel that the standard could be achieved over the full 1- to 2-year run of a fluid catalytic cracking unit. Thus, most of the commentators recommended that the emission standard be increased from 0.022 gr/dscf to 0.044 gr/dscf.

The emission data presented in Volume 1 of this document (Figure 6, page 20) in support of the proposed standard are presented in Figure 4-2 for the promulgated standard. The proposed standard of 0.022 gr/dscf is equivalent to about 0.8 kilogram per 1,000 kilograms of coke burn-off, and 0.044 gr/dscf is equivalent to about 1.6 kilograms per 1,000 kilograms of coke burn-off.

The non-EPA data points presented for facilities A and E are based on emission data supplied by the companies operating these facilities. The data for facility A that were presented in Volume 1 of this document represented results of emission tests carried out about every 2 weeks by company personnel during the first 7 months of operation of the catalyst regenerator following a turnaround of the fluid catalytic cracking unit. The data for facility E presented both in Volume 1 of this document and in Figure 4-2 represent the results of emission tests carried out about every 2 months by company personnel during 17 months of operation of the catalyst regenerator between turnarounds of the fluid catalytic cracking unit.

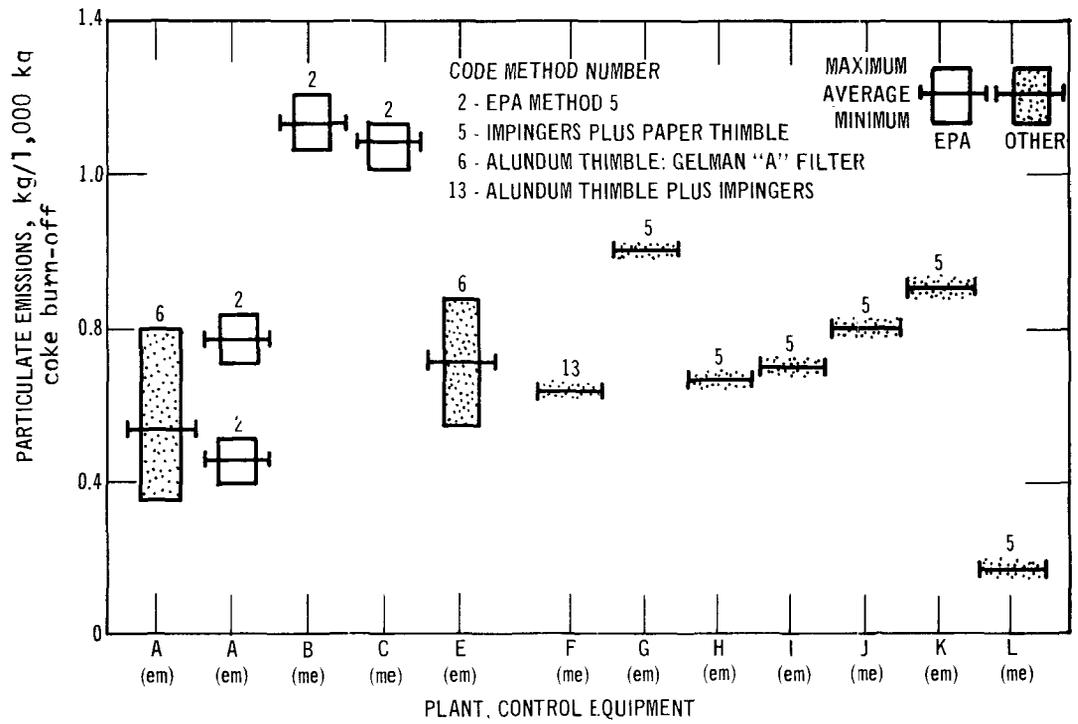


Figure 4-2. Particulate emissions from fluid catalytic cracking unit catalyst regenerators.

Following proposal of the standard, EPA requested and was supplied additional emission data by the company operating facility A. The non-EPA data point presented in Figure 4-2 for facility A now represents emission data covering 20 months of operation of the catalyst regenerator between turnarounds of the fluid catalytic cracking unit. As with the emission data initially supplied by the company operating this facility, the additional emission data consisted of the results of emission tests carried out about every 2 weeks by company personnel.

Additional emission data were also obtained on another fluid catalytic cracking unit catalyst regenerator (see the data point in Figure 4-2 for facility L). This data point is based on the results of an emission test carried out on a fluid catalytic cracking unit of about 55,000 bbl/day capacity, which was equipped with a carbon monoxide boiler followed by an electrostatic precipitator. However, at the time of the test, the fluid catalytic cracking unit had been onstream only about four months following a turn-around. Although this is not a new fluid catalytic cracking unit, a large electrostatic precipitator had been installed to control particulate emissions from the catalyst regenerator since EPA's original survey of the industry during the development of the proposed emission standard.

Although there was some consideration given during development of the proposed standard to the effect of internal-cyclone deterioration on particulate emissions from the catalyst regenerators, it was felt that this effect was relatively minor. The only data available to EPA were the data on facility E, consisting of nine data points which are so scattered that no trend in emissions over time is apparent.

Since the development of the proposed emission standard, however, the American Petroleum Institute undertook a survey of emissions from fluid catalytic cracking units. Although the information gathered by this survey is not adequate for the development of a new source performance standard, the survey data do indicate that particulate emissions from catalyst regenerators generally increase by about 35 percent during the run (between turnarounds) of a fluid catalytic cracking unit. Although there is a great deal of scatter in the data supplied by the company operating facility A, a least-squares regression analysis of these data also indicates a general increase in emissions over time (Figure 4-3).

As a result, it appears that the deterioration of internal cyclones has an adverse effect on particulate emissions released to the atmosphere from catalyst regenerators. Consequently, EPA concluded that the level of the proposed emission standard should be revised for promulgation to allow for the deterioration of the process equipment which would cause emissions to increase. The goal was then to develop an emission standard consistent with the performance of the best system of emission control on a catalyst regenerator over the normal run of a fluid catalytic cracking unit between turnarounds.

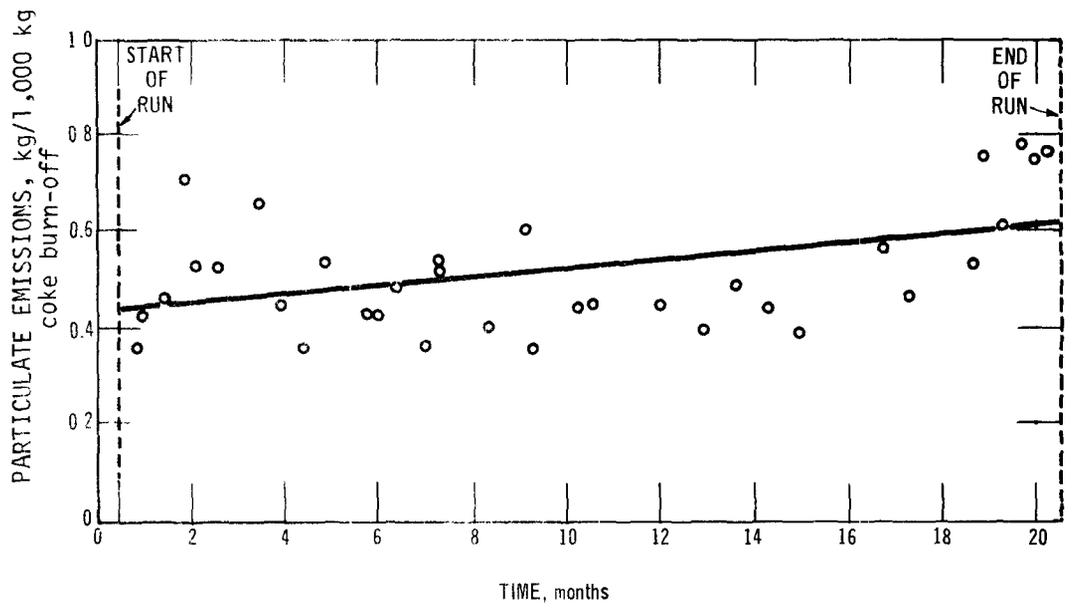


Figure 4-3. Particulate emissions versus time for facility A.

As discussed in Volume 1 of this document, collection efficiency for particulate emissions is closely related to the size of the plate area of the electrostatic precipitator. Facilities B and C (Figure 4-2) respectively employed precipitators with 175 and 190 square feet of plate area per 1,000 acfm of gases treated, and emissions were in the range of 1.2 to 1.4 kilograms per 1,000 kilograms of coke burn-off. Facility E employed a precipitator with 225 square feet of plate area per 1,000 acfm of gases treated, and emissions were in the range of 0.5 to 0.9 kilogram per 1,000 kilograms of coke burn-off. Facility A employed a precipitator with 250 square feet of plate area per 1,000 acfm of gases treated, and emissions were in the range of 0.4 to 0.8 kilogram per 1,000 kilograms of coke burn-off. Facility L employed a precipitator with 350 square feet of plate area per 1,000 acfm of gases treated, and emissions were in the range of 0.1 to 0.2 kilogram per 1,000 kilograms of coke burn-off. Similar data are not available on facilities F through K.

Because these data points are not necessarily on the same basis, they cannot be used to develop a quantitative relationship between the ratio of precipitator plate area to the volume of gases treated or to particulate emissions from catalyst regenerators. However, they do qualitatively confirm the basic design criteria; i.e., that as precipitator plate area increases, particulate collection efficiency increases and emissions decrease.

EPA's data shown in Figure 4-2 for facility A were obtained after the catalyst regenerators had been onstream about 6 and 8 months, respectively, following a turnaround of the fluid catalytic cracking unit. The data for facility L were obtained after the catalyst regenerator had been onstream about 4 months following a turnaround. The data supplied by the companies operating facilities A and E, however, were obtained over the full run of the fluid catalytic cracking unit. In addition, these two companies used the same test method to determine particulate emissions; therefore, the company-supplied data on these two facilities can be assumed to be on the same basis.

The EPA data and the company data on facilities A and E are not on the same basis, however, since the emission testing methods used by EPA and these two companies differ in many respects. On the other hand, it appears from Figure 4-2 that the company data and the EPA data are somewhat comparable because the EPA data for facility A are in the same general range as the company data for facility A. Therefore, the EPA data indicate that an emission standard in the range of 1.0 kilogram per 1,000 kilograms of coke burn-off in the catalyst regenerator would appear to be consistent with the performance of the best system of emission control, and the company data indicate that this standard would not significantly reduce the length of a normal run for a fluid catalytic cracking unit.

Another approach to establishing a level for the promulgated standard is to statistically analyze the emission data supplied by the company operating facility A. The mean and standard deviation of these data for the full 20-month run are 0.518 and 0.125 kilogram per 1,000 kilograms of coke burn-off in the catalyst regenerator, respectively. Averaging the EPA data on facility A yields a value of 0.646 kilogram per 1,000 kilograms of coke burn-off. The assumption that the data supplied by the company operating facility A are somewhat comparable to EPA's data leads to the additional assumption that the variance and standard deviation of the company data provide an estimate of the variance and standard deviation which might have been observed if EPA had tested facility A over the full 20 months between turnarounds.

Using these assumptions, an estimate can be made of what the level of an emission standard should be to ensure that the standard does not significantly shorten the length of a normal run for a fluid catalytic cracking unit, while also ensuring a level of control consistent with the performance of facility A. If the value of one standard deviation is added to the average of the EPA data for facility A, a value of 0.771 kilogram per 1,000 kilograms of coke burn-off is yielded. Statistically, this implies that if facility A had been tested by EPA over the full 20 months between turnarounds, about 16 percent of the emission data would exceed 0.771 kilogram per 1,000 kilograms of coke burn-off.

If the value of two or three standard deviations is added to the average of the EPA data for facility A, values of 0.896 or 1.021 kilogram per 1,000 kilograms of coke burn-off are yielded. Statistically, this implies that if facility A had been tested by EPA over the full 20 months between turnarounds, about 2.5 percent or 0.15 percent of the emission data would exceed 0.896 or 1.021 kilograms per 1,000 kilograms of coke burn-off.

While the assumptions necessary to support this type of a statistical analysis are subject to question, the exercise does tend to indicate that an emission standard of 1.0 kilogram per 1,000 kilograms of coke burn-off is consistent with the performance of a well-controlled catalyst regenerator over the normal run length of a fluid catalytic cracking unit.

As a result, a standard is promulgated limiting the rate of emission of particulate matter to the atmosphere from fluid catalytic cracking unit catalyst regenerators to no more than 1.0 kilogram per 1,000 kilograms of coke burn-off in the catalyst regenerator.

Exemption of Small Sources

A number of comments were received requesting that small fluid catalytic cracking unit catalyst regenerators be exempted from the standards due to the economic impact that

compliance would impose on small refineries.

Background information considered in proposing the standards for fluid catalytic cracking unit catalyst regenerators included the economic impact of the proposed standards. Essentially, EPA's analysis indicated that the proposed standards would have little or no economic impact on either small (20,000 bbl/day) or large (65,000 bbl/day) fluid catalytic cracking units. However, in light of the comments received, the economic impact of the standards was reexamined.

This analysis of the economic impact of the promulgated standards on fluid catalytic cracking unit catalyst regenerators also indicates that the standards should impose no barriers to growth for small petroleum refineries. Consequently, the promulgated standards apply equally to both small and large fluid catalytic cracking unit catalyst regenerators.

The EPA analysis is included in Appendix C. The economic impact of only the particulate emission standard is examined in this analysis. If the net impact of the carbon monoxide standard and the particulate matter standard is considered, the cost savings generated from steam production in the carbon monoxide boiler more than offset the costs of both the carbon monoxide boiler and the electrostatic precipitator. Although not specifically addressed in Volume 1, this is also the case when in situ combustion of the carbon monoxide in the catalyst regenerator (control system 1 in Figure 4-1), rather than a carbon monoxide boiler, is used to control carbon monoxide emissions. In this case, the cost savings resulting from improved catalyst activity and selectivity, which lead to improved gasoline yields, for example, are more than adequate to offset both the costs associated with in situ combustion and the electrostatic precipitators.

The EPA analysis presented in Appendix C examines not only the economic impact of the standard for fluid catalytic cracking unit catalyst regenerators. It also examines the combined economic impact of this standard, the standard for fuel gas combustion devices, the water quality effluent guidelines for petroleum refineries being developed, and EPA's regulations requiring the reduction of lead in gasoline. Because this analysis was discussed in the previous section concerning the promulgated standard for fuel gas combustion systems, a discussion of the analysis will not be presented here. The reader is referred to either Appendix C or the previous section concerning the promulgated standards for fuel gas combustion devices.

CHAPTER 5. STORAGE VESSELS FOR PETROLEUM LIQUIDS

SUMMARY OF PROMULGATED STANDARD

The promulgated standard applies to storage vessels with capacities greater than 151,412 liters (40,000 gallons) that contain crude petroleum, condensate, or finished or intermediate products of a petroleum refinery. The standard limits hydrocarbon emissions from any such storage vessel by requiring equipment as follows:

1. If the true vapor pressure under actual storage conditions is equal to or greater than 78 mm Hg (1.5 psia), but not greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a floating roof, a vapor recovery system, or their equivalents.
2. If the true vapor pressure under actual storage conditions is greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a vapor recovery system or its equivalent.

DISCUSSION OF PROMULGATED REGULATION

The major revisions in the promulgated regulation may be summarized as follows:

- (1) The exemption threshold for tank size was reduced from 245,000 liters (65,000 gallons) to 151,412 liters (40,000 gallons).
- (2) Conservation vents are no longer required on storage vessels containing petroleum liquids at a true vapor pressure, as stored, of less than 78 mm Hg (1.5 psia).
- (3) Requirements for daily recordkeeping were deleted, and other monitoring requirements were simplified to reduce recordkeeping and to aid enforcement.
- (4) Maintenance requirements specific to storage vessels were deleted because the General Provisions of the regulations now require proper maintenance of all affected facilities.

In addition, many revisions that do not change the standard are included in the promulgated regulation. These changes, which primarily consist of clarifying detail to prevent confusion and misinterpretation, are discussed in the following sections.

Affected Facility

The definition of a storage vessel was clarified to specifically exclude high-pressure vessels, subsurface caverns, porous-rock reservoirs, and underground tanks if the total volume of petroleum liquids added to or taken from underground tanks annually does not exceed twice the volume of the tank. As commentators pointed out, these types of storage are optimum for preventing the release of emissions to the atmosphere and need no additional control devices.

The proposed definition of petroleum liquids ("crude petroleum or any derivative thereof") was criticized by several commentators for being so broad that it could be misconstrued. The promulgated definition includes crude petroleum, condensate, and any finished or intermediate products of a petroleum refinery, and excludes certain specified fuel oils. Definitions of petroleum refinery and condensate were added to accommodate these changes in the definition of petroleum liquids.

One commentator wanted the tank size exemption increased to 320,000 liters (84,500 gallons) because this size is most commonly used for storage of diesel fuels and the mixtures of petroleum liquids known as pipeline interfaces. EPA agrees that storage of such low-volatility liquids should be exempt from the standard; rather than increase the tank-size exemption, however, the Agency expanded the definition of petroleum liquids to specifically exclude certain low-volatility diesel fuels. Low-volatility interfaces (less than 78 mm Hg or 1.5 psia) are now exempt from the hydrocarbon standard because conservation vents are no longer required on vessels containing liquids at these pressures.

Many commentators stated that storage of crude oil and condensate at production facilities in the field should be exempt from the standard. EPA intended such storage to be exempt by the selection of the minimum tank size to which the standard would apply. Industry representatives had indicated that the exemption size proposed, 245,000 liters (65,000 gallons), would exempt essentially all of the tanks in the producing field. However, data have since been presented that indicate larger tanks are sometimes used in these locations. The designation of the affected facility was thus revised to explicitly exempt storage of crude petroleum or condensate at producing facilities in the field. The exemption applies to storage between the time that the oil and condensate are removed from the ground and the time that custody of these products is transferred from the well or producing operations to the transportation operations. Producing field storage is exempt because the low level of emissions, the relatively small size of these tanks, and their commonly remote locations do not justify the switch from the bolted-construction, fixed-roof tanks in common use to the welded-construction, floating-roof tanks that would be required for new sources to comply with the standards.

The standard as originally conceived was to apply to tanks with capacities greater than 40,000 gallons in order to be consistent with existing State and local regulations. As previously stated, the tank-size exemption for the proposed standard was instead set at 65,000 gallons in order to exempt storage of crude oil and condensate in the field. Because the promulgated standard now specifically exempts such storage, the minimum exemption size has been reduced from 65,000 gallons to 40,000 gallons. Of the total number of storage vessels to which the standard applies, only 2 percent will be affected by this exemption size reduction.

Two definitions were added to the regulation as a result of the addition of the exemption for storage of crude oil and condensate in the field. The definition of a drilling and production facility lists the equipment covered by the exemption, and custody transfer is defined to specify the point at which the exemption no longer applies.

The Standard

The proposed standard required the use of a conservation vent or its equivalent on storage vessels containing petroleum products with a true vapor pressure at actual storage conditions of less than 78 mm Hg (1.52 psia). Several commentators pointed out, and EPA agrees, that certain stocks can cause serious operating problems by fouling the conservation vents, that these vents are frequently locked open or removed in winter to prevent freezing, and that the beneficial effects of these vents on emissions are minimal. This requirement was deleted from the promulgated standard.

Vapor recovery systems are cited in the standard as satisfactory control devices for emissions from petroleum liquids stored at certain specified conditions. Several commentators objected to the definition of a vapor recovery system because the wording ("disposal system . . . to prevent . . . emission to the atmosphere") could be interpreted as demanding 100 percent recovery. EPA recognizes that recovery efficiencies will vary according to climate and the types and concentrations of the vapors processed, and has deliberately not required a specific level of efficiency. Control systems which are capable of providing an equivalent amount of control of hydrocarbon emissions may be used in lieu of the systems specified by the standard. An example of an equivalent control system is one which incinerates with an auxiliary fuel the hydrocarbon emissions from the storage tank before such emissions are released into the atmosphere.

At the suggestion of several commentators, the definition of floating roof, another control option specified in the standard, was extended to include covered floating roofs and internal floating covers.

Monitoring

Over half of the comments received concerning storage vessels contained objections to various aspects of the proposed monitoring regulation, particularly the portion that required daily records of transfer operations, tank temperatures, and true vapor pressures. In a large, modern petroleum refinery, which was the type of operation used as a basis for the standard, these items could be recorded and filed with little difficulty. Many of the commentators, however, validly argued that such files would be an unjustifiable record-keeping burden on remote tank farms, terminals, and marketing operations; the monitoring requirements have been revised to eliminate the requirements for daily recordkeeping.

Other monitoring requirements have been relaxed as well. The proposed regulation required owners or operators of storage vessels containing petroleum liquids at specified pressures to provide, in addition to the daily records, monthly summaries of the types of liquids stored, quantity transferred, bulk temperatures, and true vapor pressures. Under the promulgated regulation, all owners or operators of any storage vessels subject to the standard must only maintain a file on types of liquids stored, typical Reid vapor pressures of each, dates of storage, and dates on which the vessel is empty. Average monthly storage temperatures and true vapor pressures are also required for liquids at certain specified storage conditions. The simplified monitoring regulation will aid both operators and enforcement officials by reducing paperwork without sacrificing the objectives of the standard.

A definition of Reid vapor pressure was added to the regulations in accordance with the changes in the monitoring requirements.

Maintenance

Comments received indicated that the maintenance requirements were not feasible because they were not specific enough. In addition, a revision to the General Provisions (subpart A, 40 CFR 60) requires all affected facilities to be operated and maintained in a manner consistent with good air pollution control practice for minimizing emissions. This provision will ensure good maintenance practices, which was the purpose of the proposed maintenance requirements for storage vessels. Maintenance requirements specific to storage vessels were thus deleted.

CHAPTER 6. SECONDARY LEAD SMELTERS AND REFINERIES

SUMMARY OF PROMULGATED STANDARDS

The promulgated standards of performance for secondary lead smelters and refineries limit emissions of particulate matter from blast (cupola) and reverberatory furnaces as follows:

1. No more than 50 mg/dscm (0.022 gr/dscf).
2. Less than 20 percent opacity.

Visible emissions from any pot furnace with a charging capacity of more than 250 kilograms (550 pounds) shall be less than 10 percent opacity. Visible emissions caused solely by the presence of uncombined water are not subject to the opacity standards.

DISCUSSION OF PROMULGATED REGULATION

No substantial changes have been made to the proposed concentration standard for secondary lead smelters and refineries. However, some minor rewording and reorganization changes that do not change the standard are included in the promulgated regulations.

To avoid repetition, the provision covering emission-records requirements, the definition of particulate matter, and the provision prohibiting the use of dilution air were removed from individual regulations and incorporated in the General Provisions, which are applicable to all sources. The paragraph concerning dilution air has also been revised to clarify misunderstandings evidenced by comments received during the public comment period. Other clarifications include: (1) deletion of "normal" from the particulate concentration standard to avoid confusion between "normal" and "standard," (2) substitution of a more specific statement of conditions under which performance tests will be conducted, and (3) deletion of a confusing and repetitive statement concerning the date upon which the standard becomes applicable. Several other changes, made to clarify EPA's intent, were incorporated in the test methods and procedures. These include a revision of the sampling time specified for performance testing, and inclusion of an exception to the promulgated procedures to make clear EPA's recognition that process variables may interfere with specified sampling conditions.

Because these changes in the regulations apply to nearly all of the sources for which standards are promulgated, the rationale for changes is presented in Chapter 2, General Considerations, of this volume.

A minor revision, the removal of the 2-minute-per-hour exemption from the opacity standards, has been made to the regulation for secondary lead smelters and refineries. This revision is based on new data, reevaluation of the data collected before proposal of the regulation, and the separate promulgation of exemptions from opacity standards during periods of startup, shutdown, or malfunction.

Comments were received on both the opacity limit and the time exemption provisions of the proposed regulation. Additional data were obtained during 9 hours of continuous observations at one plant that met the concentration standard of 50 mg/dscm. Two qualified observers visually determined the opacity of emissions from one reverberatory furnace and one blast furnace vented to the same stack. During these 9 hours, the only visible emissions were at 5 percent opacity for 90 seconds and at 20 to 100 percent opacity for 17 minutes. The emissions at 20 to 100 percent opacity were caused, respectively, by a hole in a bag and by the bypassing of an entire section of the baghouse. These two circumstances are considered malfunctions, and opacity standards do not apply during periods of malfunction. (See the regulations recently promulgated in the Federal Register of October 15, 1973, 38 FR 28564, which exempt from opacity standards any emissions generated during startups, shutdowns, or malfunctions.) The new data provide information consistent with the summaries of source tests submitted to EPA by the Los Angeles County Air Pollution Control District under contract no. 2P0-68-02-3326. The Los Angeles County data, used as part of the basis for the proposed standard, were obtained from four plants that met the concentration standard. Emissions from three blast furnaces and one reverberatory furnace were observed for a total of 4 hours and no visible emissions were detected.

The proposed 2-minute time exemption was not based on observed increases in opacity, but was an arbitrary selection of time intended to prevent uncontrollable short-term emissions from constituting violations. The exemptions now provided by the promulgated startup-shutdown-malfunction regulations cover circumstances specific to the source. The data show that the promulgated opacity limit of less than 20 percent allows minor variations and that there are no operating circumstances or process variables that would require exemptions in addition to those provided by the startup-shutdown-malfunction regulations.

In the judgment of the Administrator, these data show that the promulgated (and proposed) opacity limit is sufficiently close to observed opacity to ensure proper operation and maintenance of the process and collection equipment, and that the limit, coupled with the exemptions for startups, shutdowns, and malfunctions, constitutes an opacity standard that is not more restrictive than the concentration standard. A general discussion of the intent of opacity standards and the issues involved in setting them is included in Chapter 2 of this volume.

CHAPTER 7. SECONDARY BRASS AND BRONZE INGOT PRODUCTION PLANTS

SUMMARY OF PROMULGATED STANDARDS

The promulgated standards of performance for secondary brass or bronze ingot production plants limit emissions of particulate matter from reverberatory furnaces having production capacities of 1,000 kg (2,205 lb) or greater as follows:

1. No more than 50 mg/dscm (0.022 gr/dscf).
2. Less than 20 percent opacity.

Visible emissions from any electric furnace of 1,000 kg (2,205 lb) or greater production capacity or from any blast (cupola) furnace of 250 kg/hr (550 lb/hr) or greater capacity shall not exhibit 10 percent opacity or greater. Visible emissions caused solely by the presence of uncombined water are not subject to the opacity standards.

DISCUSSION OF PROMULGATED REGULATION

No substantial changes have been made to the proposed concentration standard for secondary brass and bronze ingot production plants. However, some minor rewording and reorganization changes that do not change this standard are included in the promulgated regulations.

To avoid repetition, the provision covering emission-records requirements, the definition of particulate matter, and the provision prohibiting the use of dilution air were removed from individual regulations and incorporated in the General Provisions, which are applicable to all sources. The paragraph concerning dilution air has also been revised to clarify misunderstandings evidenced by comments received during the public comment period. Other clarifications include: (1) deletion of "normal" from the particulate concentration standard to avoid confusion between "normal" and "standard," (2) substitution of a more specific statement of conditions under which performance tests will be conducted, and (3) deletion of a confusing and repetitive statement concerning the date upon which the standard becomes applicable. Several other changes, made to clarify EPA's intent, were incorporated in the test methods and procedures. These include a revision of the sampling time specified for performance testing, and inclusion of an exception to the promulgated procedures to make clear EPA's recognition that process variables may interfere with specified sampling conditions.

Because these changes in the regulations apply to nearly all of the sources for which standards are promulgated, the rationale for changes is presented in Chapter 2, General Considerations, of this volume.

Change in the Opacity Standards

The opacity standards for brass and bronze ingot production plants have been revised to reflect new data, reevaluation of the data collected before proposal of the regulation, and the separate promulgation of regulations which exempt from opacity standards any emissions generated during periods of startup, shutdown, or malfunction (see Federal Register of October 15, 1973, 38 FR 28564).

In response to comments received during the public comment period, additional data were obtained from two well-controlled reverberatory furnaces. The first of these furnaces, controlled by a baghouse, was source-tested during the development of the proposed standard and found to meet the concentration limit. The opacity of emissions from this baghouse was determined visually by two qualified observers. Observations, made continuously for 4 hours, showed that emissions from the baghouse varied from 0 to 10 percent opacity. All observations were made during the refining process--that portion of the ingot production cycle judged by EPA and by plant operators to cause the greatest amount of the most visible emissions. In addition, the particulate concentration to the baghouse was considered to be high because a large percentage of zinc was present in the scrap. The furnace was being used to oxidize the zinc so that it would be removed as zinc oxide in the ventilation gases ducted to the baghouse. Thus, even under heavy load conditions, this baghouse easily met the promulgated opacity standard.

The second plant was tested continuously for 5 hours, also by two qualified observers, and similar data were obtained. Observations were made of emissions from a baghouse controlling both a blast (cupola) furnace and a reverberatory furnace. This baghouse was also source-tested during the development of the proposed standard, but malfunctions invalidated the data obtained, and no judgment was made as to whether this baghouse could meet the concentration standard. As in the plant above, emissions varied from 0 to 10 percent opacity.

The proposed 2-minute time exemption was not based on observed increases in opacity, but was an arbitrary selection of time intended to prevent uncontrollable short-term emissions from constituting violations. The exemptions now provided by the promulgated startup-shutdown-malfunction regulations cover circumstances specific to the source. The data show that the promulgated opacity limit of less than 20 percent allows minor variations and that there are no operating circumstances or process variables that would require exemptions in addition to those provided by the startup-shutdown-malfunction regulations.

In the judgment of the Administrator, these data show that the promulgated opacity limit is sufficiently close to observed opacity to ensure proper operation and maintenance of the process and collection equipment, and that the limit, coupled with the exemptions for startups, shutdowns, and malfunctions, constitutes an opacity standard that is not more restrictive than the concentration standard. A general discussion of the intent of opacity standards and the issues involved in setting them is included in Chapter 2 of this volume.

CHAPTER 8. IRON AND STEEL PLANTS

SUMMARY OF PROMULGATED STANDARD

The promulgated standard of performance for iron and steel plants limits emissions of particulate matter from basic oxygen process furnaces to no more than 50 mg/dscm (0.022 gr/dscf).

DISCUSSION OF PROMULGATED REGULATION

Some minor rewording and reorganization that do not change the standard are included in the promulgated regulations. The proposed opacity standard covering iron and steel plants has been withdrawn for further study. Comments received pointed out the inappropriateness of the proposed standard (10 percent opacity except for 2 minutes each hour) for this cyclic steel-making process. The separate promulgation of regulations (see Federal Register of October 15, 1973, 38 FR 28564) which provide exemptions from opacity standards during periods of startup, shutdown, and malfunction added another dimension to the problem, and the collection of new data shows variations in opacity for reasons not yet well enough identified.

To avoid repetition, the provision covering emission-records requirements, the definition of particulate matter, and the provision prohibiting the use of dilution air were removed from individual regulations and incorporated in the General Provisions, which are applicable to all sources. The requirement concerning dilution air has been removed from this regulation and dealt with as a general provision (subpart A) applicable to all sources to clarify misunderstandings evidenced by comments received during the public comment period. Other clarifications include: (1) deletion of "normal" from the particulate concentration standard to avoid confusion between "normal" and "standard," (2) substitution of a more specific statement of conditions under which performance tests will be conducted, and (3) deletion of a confusing and repetitive statement concerning the date upon which the standard becomes applicable. Several other changes, made to clarify EPA's intent, were incorporated in the test methods and procedures. These include a revision of the sampling time specified for performance testing, and inclusion of an exception to the promulgated procedures to make clear EPA's recognition that process variables may interfere with specified sampling conditions.

Because these changes in the regulations apply to nearly all of the sources for which standards are promulgated, the rationale for these changes is presented in Chapter 2, General Considerations, of this volume.

CHAPTER 9. SEWAGE TREATMENT PLANTS

SUMMARY OF PROMULGATED STANDARDS

The promulgated standards of performance for sewage treatment plants limit particulate emissions from sludge incinerators at municipal sewage treatment plants as follows:

1. No more than 0.65 g/kg dry sludge input (1.30 lb/ton dry sludge input).
2. Less than 20 percent opacity.

Visible emissions caused solely by the presence of uncombined water are not subject to the opacity standard.

DISCUSSION OF PROMULGATED REGULATION

The major changes from the proposed to the promulgated regulation are:

1. The standard is now based on units of mass rather than on the proposed units of concentration.
2. The opacity standard was changed from the proposed limit of less than 10 percent except for 2 minutes in any 1 hour to less than 20 percent.
3. To accommodate the change of units, the section on test methods was revised and a section on monitoring requirements was added.

Some minor rewording and reorganization changes that do not change the standard are also included in the promulgated regulation. For example, the designation of the affected facility was clarified and several definitions were deleted. To avoid repetition, the provision covering emission-records requirements and the definition of particulate matter were removed from individual regulations and incorporated into the General Provisions, which are applicable to all sources.

Change of Units for the Standard

Emission limits were proposed in terms of concentration (mg/Nm^3). Sludge incineration, like most combustion processes, requires more air than is actually used in the combustion process. This "excess air" promotes combustion, but the amount of excess air used varies significantly from plant to plant. In addition, gases from a multiple-hearth incinerator are often diluted with shaft cooling air upstream of the sampling point. Both excess air and shaft cooling air dilute the gases discharged to the atmosphere and thereby decrease particulate concentration.

EPA studied these problems prior to proposal of the regulation and concluded that a concentration standard would still be acceptable for the following reasons:

Excess air - Sludge incineration is not self-sustaining at the temperatures desired and auxiliary fuel must be used. Excess air absorbs heat, increasing auxiliary fuel requirements. The volume of gases which must be treated by the scrubber also increases. Economics, then, encourages operation at the lowest feasible level of excess air.

Shaft cooling air (multiple-hearth incinerators only) - Since shaft cooling air bypasses the incinerator and the scrubber, economics does not limit the use of this air as a diluent. A provision was written into the regulation to solve this problem by requiring that the amount of such dilution be determined by the owner or operator. The results would then be corrected to an undiluted basis.

Comments on the proposed regulations and additional discussions with industry experts have revealed two difficulties with this approach.

First, dilution does occur and is significant. Percent CO_2 , an inverse function of excess air, averaged 12.3 percent on a fluidized-bed incinerator and 10.1 percent on a multiple-hearth incinerator during EPA tests. This means that if the two incinerators were discharging the same quantity (pounds per hour) of particulate matter, the concentration of particulate matter in the gases from the multiple-hearth incinerator would be approximately 20 percent less than the concentration in the gases from the fluidized-bed unit because of the difference in the amount of air dilution.

Second, the control devices normally used on sludge incinerators--wet scrubbers--absorb some of the CO_2 present in the gases discharged to the atmosphere. This, as well as the CO_2 contributed by auxiliary fuel, alters the gas composition and precludes the relatively simple correction of results to a reference basis such as 12 percent O_2 . Determination of the amount of dilution could then prove difficult. Gas velocity determination, the most practical alternative to CO_2 correction, is of use only when dilution air is added following the incinerator. It can seldom be used to determine the amount of excess air, and its use in determining shaft cooling air or other dilution is limited by the need for simultaneous traverses and/or unfavorable ductwork configurations. Introduction of shaft cooling air would be prohibited prior to the sampling site, but such regulation would not affect excess air and auxiliary fuel variations.

Expressing the standard in mass units of grams particulate per kilogram of dry sludge fed to the incinerator (g/kg) avoids the above problems. Data from the incinerators tested are presented in terms of mass in Figure 9-1. The test results shown in this figure are far different in relation to the standard and to each other than are the results shown in terms of concentration in Volume 1 of this series

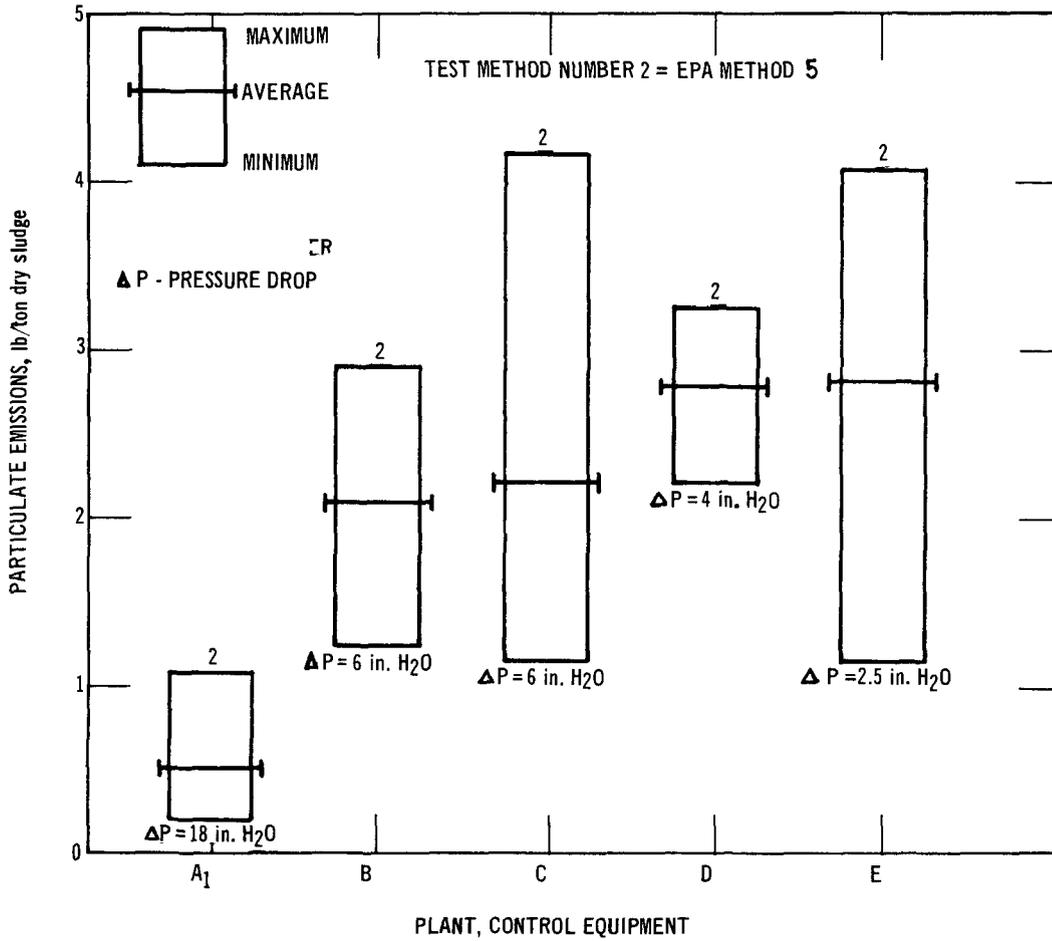


Figure 9-1. Particulate emissions from sludge incinerators at sewage treatment plants.

of documents. For example, the test results in terms of concentration indicate that Plant C almost meets the proposed standard, but these same results converted to mass units show that Plant C does not come close to meeting the promulgated standard. Differences of this type are attributable to the various amounts of combustion air used in the individual plants. Test results are thus unaffected by either dilution or combustion air volume when expressed in terms of mass.

Average values of Plant A test results were used to convert the proposed standard (70 mg/Nm³ or 0.03 gr/dscf) to mass units:

$$0.031 \text{ gr/dscf (proposed NSPS)} \times \frac{0.481 \text{ lb/ton (Plant A avg.)}}{0.01 \text{ gr/dscf (Plant A avg.)}} = \begin{matrix} 1.30 \text{ lb/ton} \\ \text{or} \\ 0.65 \text{ g/kg} \end{matrix}$$

Thus, the level of control required by the standard is unaffected; only the units have been changed.

The new units require determination of dry sludge feed rate (input). The promulgated regulation details the information needed, usually only two items: liquid sludge flow rate and dry sludge weight per unit volume of liquid sludge.

Change in the Opacity Standard

The opacity standard covering sewage treatment plants has been revised to reflect new information obtained on a well-controlled plant and to reflect the recently promulgated regulations which exempt from opacity standards any emissions generated during periods of startup, shutdown, or malfunction (see Federal Register of October 15, 1973, 38 FR 28564).

New data were obtained from a well-controlled sludge incinerator. This incinerator was the one previously tested by EPA that met the promulgated process weight standard. The opacity of emissions from this incinerator was determined visually by two qualified observers during 6.25 hours of continuous observation. The only visible emissions observed were for 45 seconds at 10 percent opacity and for 35 minutes at 5 percent opacity.

The proposed 2-minute time exemption was not based on observed increases in opacity, but was an arbitrary selection of time intended to prevent uncontrollable short-term emissions from constituting violations. The exemptions now provided by the startup-shutdown-malfunction regulations cover circumstances specific to the source. The data show that the promulgated opacity limit of less than 20 percent allows minor variations and that there are no operating circumstances or process variables that would require exemptions in addition to those provided by the startup-shutdown-malfunction regulations.

In the judgment of the Administrator, these data show that the promulgated opacity limit is sufficiently close to observed opacity to ensure proper operation and maintenance of the process and collection equipment, and that the limit, coupled with the exemptions during startups, shutdowns, and malfunctions, constitutes an opacity standard that is not more restrictive than the concentration standard. A general discussion of the intent of opacity standards and the issues involved in setting them is included in Chapter 2 of this volume.

Emission Test Conditions

Three of the five plants tested by EPA (Plants B, C, and E) operated at sludge burning rates far below the design rate during the tests. These low burning rates, as one commentator pointed out, result in gas flow through a multiple-hearth incinerator system at rates below those for which the scrubbers were designed. The low gas flow rates adversely affect scrubber efficiency unless the control device, e.g., a venturi scrubber with an adjustable throat, can compensate for changes in flow. However, tabulation of the results from Plants B through E (all equipped with impingement-type scrubbers) shows no relationship between mass emissions and percent of rated capacity (Table 9-1). Instead, mass emissions from these facilities appear strongly dependent on pressure drop across the scrubber (Table 9-2). Why, though, is there little or no effect at decreased burning capacity? One manufacturer* suggests that, for multiple-hearth furnaces, the decrease in gas flow rate results in less entrainment of fly ash. Therefore, the amount of particulate matter entering the scrubber is less. The two changes cancel each other out, and the mass emission rate remains fairly constant over a wide range of feed rates.

For fluidized-bed incinerators, operating conditions are more rigid. Gas flow rate must be high enough to keep the sand fluid, so it cannot be decreased at lower feed rates. Both fluidized-bed units tested by EPA operated at nearly 100 percent capacity during the tests, so the effect of reduced feed rates is not known, but the necessity of maintaining a fluidized bed, in the Administrator's best judgment, precludes operating these units at gas flow rates that would adversely affect control device efficiency.

*Telephone communication with Mr. Mark Helms, Envirotech Corp., Menlo Park, CA 94025.
September 18, 1973.

Table 9-1. RELATIONSHIP OF OPERATING AT LESS THAN RATED
CAPACITY TO MASS EMISSIONS FROM
IMPINGEMENT SCRUBBERS^a

Plant	Type of incinerator	Operation, % of rated capacity	Mass emissions, lb/ton
D	Fluidized-bed	95	2.77
B	Multiple-hearth	64	2.09
E ^b	Multiple-hearth	50	2.80
C	Multiple-hearth	35	2.21

^aPlant A's scrubber is a different design (venturi), so Plant A is not included in the table.

^bPlant E has a cyclonic rather than a plate scrubber, but the efficiency is similar (Scrubber Handbook, Chapter 3).

Table 9-2. RELATIONSHIP OF PRESSURE DROP TO MASS EMISSIONS
FROM IMPINGEMENT SCRUBBERS^a

Plant	Type of incineration	Pressure drop, in. H ₂ O	Mass emissions, lb/ton
B	Multiple-hearth	6	2.09
C	Multiple-hearth	6	2.21
D	Fluidized-bed	4	2.77
E ^b	Multiple-hearth	2.5	2.80

^aPlant A's scrubber is a different design (venturi), so Plant A is not included in the table.

^bPlant E has a cyclonic rather than a plate scrubber, but the efficiency is similar (Scrubber Handbook, Chapter 3).

APPENDIX A. ASPHALT CONCRETE PLANT DATA SUBMITTED AFTER PROPOSAL

The partial or complete stack test reports submitted in response to EPA's request for factual data are presented in this appendix. Test reports were received for 11 wet scrubber-equipped plants, five baghouse-equipped plants, and two venturi scrubber-equipped plants. With one exception, stack tests of the baghouse- and venturi scrubber-equipped plants were done using test procedures in general conformance with EPA method 5. The test results for facility P were considered to be invalid for the reasons indicated in Table A-2. With the exception of the data from the wet scrubber-equipped plants and the data for facility P, all of the average outlet concentrations are summarized in Table 3-2 in Chapter 3. The exhaust gases were analyzed at each plant after they were discharged from the control equipment. These gases included dryer exhaust gases and sweep air used to gather dust at such points in the system as elevators, screens, and scavenger systems. Most of the data for the wet scrubber-equipped plants were collected using the San Bernardino County Air Pollution Control District's test procedure.

EPA also received the final test results for 13 baghouse- or venturi scrubber-equipped plants using valid and known testing procedures, and data showing average outlet concentrations for 25 plants that had unknown control equipment or were tested using unknown test procedures. The data for these 38 plants are summarized in Table 3-1; they are not, however, included in this appendix due to a lack of information necessary to evaluate the data.

Table A-1. Asphalt Concrete Facility 0^a

Run number	1	2	3	Average
Date	4/3/73	4/3/73	4/4/73	
Test time, minutes	144	144	144	144
Production rate, tons/hr	300	315	271	295
Stack Effluent				
Flowrate, dscfm	36,217	36,396	36,675	36,429
Flowrate, dscf/ton product	7267.6	6932.6	8119.9	7409
Temperature, °F	140	145	143	143
Water Vapor, Vol. %	16.7	15.4	14.2	15.4
CO ₂ , Vol. %	2.2	2.2	2.2	2.2
O ₂ , Vol. %	17.4	17.4	17.4	17.4
CO, vol. %	—	—	—	—
Visible emissions, % opacity	—	—	—	—
Particulate emissions				
Probe and filter catch				
gr/dscf	0.0297	0.0299	0.0413	0.0336
gr/acf	0.0287	0.0290	0.0407	0.0326
lb/hr	9.21	9.33	12.97	10.50
lb/ton of product	0.0308	0.0296	0.0478	0.0361
Total Catch				
gr/dscf	—	—	—	—
gr/acf	—	—	—	—
lb/hr	—	—	—	—
lb/ton of product	—	—	—	—

^aOil-fired (No. 2 diesel oil), 250-tons/hr-capacity plant equipped with a cyclone and a baghouse with a design air-to-cloth ratio of 6-to-1. Plant was operating at capacity during the test periods. Data were provided by the National Asphalt Pavement Association in their public comment.

Table A-2.. Asphalt Concrete Facility P^a

Run number	M	1	2	Average
Date	11/15/72	11/15/72	11/15/72	
Test time, minutes	90	74	62	75.3
Production rate, tons/hr	~250	~250	~250	~250
Stack Effluent				
Flowrate, dscfm	—	—	—	—
Flowrate, dscf/ton product	—	—	—	—
Temperature, °F	192	194	190	192
Water Vapor, vol. %	10.33	9.36	9.59	9.76
CO ₂ , vol. %	2.2	2.2	2.2	2.2
O ₂ , vol. %	4.64	4.64	4.64	4.64
CO, vol. %	—	—	—	—
Visible emissions, % opacity	—	—	—	—
Particulate emissions				
Probe and filter catch				
gr/dscf	0.091	0.084	0.098	0.0904
gr/acf	—	—	—	—
lb/hr	30.80	28.55	32.63	31.36
lb/ton of product	—	—	—	—
Total Catch				
gr/dscf	—	—	—	—
gr/acf	—	—	—	—
lb/hr	—	—	—	—
lb/ton of product	—	—	—	—

^aOil-fired (No. 2 diesel oil), 300-tons/hr-design-capacity plant equipped with a cyclone and a baghouse with a design air-to-cloth ratio of 6-to-1. Plant was operating at about 80 percent capacity during the test periods. Data were provided by the National Asphalt Pavement Association in their public comment. Test results were considered unacceptable because:

- (1) the velocity head data suggest that the samples were obtained in a region of turbulent flow, and
- (2) the sampling time used at each point was not constant.

Thus, the use of only 10 sample points does not conform to the minimum criteria specified in methods 1 and 2 and places the accuracy of the test data in serious question.

Table A-3. Asphalt Concrete Facility Q^a

Run number	1	2	Average
Date	10/25/72	10/26/72	
Test time, minutes	54	54	54
Production rate, tons/hr	—	—	—
Stack Effluent			
Flowrate, dscfm	18,700	19,830	19,265
Flowrate, dscf/ton product	—	—	—
Temperature, °F	200	200	200
Water Vapor, vol %	19.0	16.3	17.65
CO ₂ , vol. %		No Orsat available	
O ₂ , vol. %		No Orsat available	
CO, vol. %		No Orsat available	
Visible emissions, % opacity	—	—	—
Particulate Emissions			
Probe and filter catch			
gr/dscf	0.0156	0.0189	0.0172
gr/acf			
lb/hr	2.50	3.20	2.76
lb/ton of product	—	—	—
Total Catch			
gr/dscf	0.0661	0.0578	0.062
gr/acf	—	—	—
lb/hr	10.59	9.82	9.91
lb/ton of product	—	—	—

^aOil-fired (No. 5 grade fuel oil), 100-tons/hr-design-capacity plant equipped with a cyclone and a baghouse with a design air-to-cloth ratio of 6-to-1. Plant was operating at capacity during the test periods. Data were provided by commentator number 97. Plant was tested with a modified EPA train, but the modifications from recommended procedures are considered to be minor.

Table A-4. Asphalt Concrete Facility R^a

Run number	1	2	3	Average
Date	3/21/73	4/27/73	4/27/73	
Test time, minutes	100	100	110	103
Production rate, tons/hr	—	—	—	—
Stack Effluent				
Flowrate, dscfm	23,464	22,904	22,904	23,091
Flowrate, dscf/ton of product	—	—	—	—
Temperature, °F	219	256	255	243
Water Vapor, vol. %	14.4	25.7	25.7	21.9
CO ₂ , vol. %	2.5	3.5	3.5	3.2
O ₂ , vol. %	16.5	11.5	11.5	13.2
CO, vol. %	—	—	—	—
Visible emissions, % opacity	—	—	—	—
Particulate emission				
Probe and filter catch				
gr/dscf	0.009	0.017	0.0203	0.0138
gr/acf	0.0072	0.0124	0.0149	0.0104
lb/hr	1.86	3.28	3.95	2.73
lb/ton of product	—	—	—	—
Total Catch				
gr/dscf	0.0476	0.0366	0.0282	0.0404
gr/acf	0.0366	0.0267	0.0206	0.0301
lb/hr	9.41	7.07	5.46	7.24
lb/ton of product	—	—	—	—

^aGas-fired, 120-tons/hr-design-capacity plant equipped with a cyclone and a baghouse with a design air-to-cloth ratio of 5-to-1. Plant was operating at 75 percent design capacity during the test periods. Data were provided by a State control agency. Plant was tested with EPA's train. Minor deviations from the recommended procedures occurred, but these should not significantly affect the accuracy of the data.

Table A-5. Asphalt Concrete Facility S^a

Run number	1	2	3	Average
Date	10/30/72	10/31/72	10/31/72	
Test time, minutes	50	132	60	80.7
Production rate, tons/hr	—	—	—	—
Stack Effluent				
Flowrate, dscfm	24,500	23,800	23,800	24033
Flowrate, dscf/ton of product	—	—	—	—
Temperature, °F	294	300	300	298
Water Vapor, Vol. %	35.9	34.9	34.9	35.2
CO ₂ , vol. %	3.4	3.8	3.8	3.7
O ₂ , vol. %	14.9	14.2	14.2	14.4
CO, vol. %	0.6	0.6	0.6	0.6
Visible emissions, % opacity	—	—	—	—
Particulate emissions				
Probe and filter catch				
gr/dscf	0.026	0.017	0.020	0.0198
gr/acf	0.022	0.0114	0.013	.0139
lb/hr	5.46	3.47	4.08	4.08
lb/ton of product	—	—	—	—
Total catch				
gr/dscf	0.049	0.062	0.037	0.048
gr/acf	0.0416	0.0349	0.024	0.034
lb/hr	10.29	10.61	7.55	9.89
lb/ton of product	—	—	—	—

^a Gas-fired, 240-tons/hr-design-capacity plant equipped with a baghouse. Production during the test periods was 120 tons/hr because the aggregate was extremely wet. Data were provided by a State control agency. Plant was tested using EPA's train. Minor deviations from recommended procedures occurred, but these should not significantly affect the accuracy of the data.

Table A-6. Asphalt Concrete Facility T^a

Run number	1	2	3	Average
Date	6/14/73	6/14/73	6/15/73	
Test time, minutes	54	54	54	54
Production rate, tons/hr	—	—	—	—
Stack Effluent				
Flowrate, dscfm	24,800	25,500	25,700	25,333
Flowrate, dscf/ton of product				
Temperature, °F	110	110	110	110
Water Vapor, vol. %	9.7	10.1	8.1	9.3
CO ₂ , vol. %	1.8	1.5	0.6	1.3
O ₂ , vol. %	18.5	19.5	20.0	19.3
CO, vol. %	<0.1	<0.1	<0.1	<0.1
Visible emissions, % opacity	—	—	—	—
Particulate emissions				
Probe and filter catch				
gr/dscf	0.013	0.011	0.035	0.0208
gr/acf	0.0107	0.0086	0.028	0.0167
lb/hr	2.6	2.2	7.8	4.4
lb/ton of product	—	—	—	—
Total catch				
gr/dscf	0.018	0.015	0.037	0.0242
gr/acf	0.014	0.0116	0.030	0.0194
lb/hr	3.4	3.0	8.4	5.2
lb/ton of product	—	—	—	—

^aGas-fired plant equipped with a cyclone and a venturi scrubber operating at 10.5 inches water gauge pressure drop and approximately 15 gallons of water per 1000 scfm of exhaust gases. Production during the test periods was 130 tons/hr. Data were provided by a State control agency. Plant was tested using EPA-recommended procedures.

Table A-7. Asphalt Concrete Facility U^a

Run number	1	2	Average
Date	1/23/73	1/23/73	
Test time, minutes	72	72	72
Production rate, tons/hr	101.6	93	97.3
Stack Effluent			
Flowrate, dscfm	30,056	29,733	29,895
Flowrate, dscf/ton product	17,750	19,183	18,435
Temperature, °F	96	100.1	98
Water Vapor, vol. %	5.67	6.48	6.08
CO ₂ , vol. %	No Orsat available		
O ₂ , vol. %	No Orsat available		
CO, vol. %	No Orsat available		
Visible emissions, % opacity	0	0	0
Particulate emissions			
Probe and filter catch			
gr/dscf	0.0220	0.0179	0.020
gr/acf	—	—	—
lb/hr	5.6	4.56	5.12
lb/ton of product	0.055	0.049	0.053
Total catch			
gr/dscf	0.0286	0.0239	0.0264
gr/acf	—	—	—
lb/hr	7.34	6.06	6.76
lb/ton of product	0.0722	0.065	0.0695

^aOil-fired (No. 2 diesel oil), 100-tons/hr-design-capacity plant equipped with a cyclone and a venturi scrubber operating at 14 inches water gauge pressure drop. Plant production during the test periods was approximately at capacity for conditions prevalent at the time of the test. Data were provided by a local control agency. Plant was tested using EPA train and the results are accepted as being reasonably valid. Lack of field data precluded complete evaluation of the accuracy and representativeness of the test data.

Table A-8. Asphalt Concrete Facility V^a

Run number	1
Date	8/24/73
Test time, minutes	unknown
Production rate, tons/hr	200
Stack Effluent	
Flowrate, dscfm	27,240
Flowrate, dscf/ton of product	8172
Temperature, °F	130
Water vapor, vol. %	Not available
CO ₂ , vol. %	No Orsat available
O ₂ , vol. %	No Orsat available
CO, vol. %	No Orsat available
Visible emissions, % opacity	—
Particulate emissions	
Probe and filter catch	
gr/dscf	—
gr/acf	—
lb/hr	—
lb/ton of product	—
Total catch	
gr/dscf	0.0644
gr/acf	—
lb/hr	15.1
lb/ton of product	0.0755

^aGas-fired, 360 tons/hr-design-capacity plant equipped with a cyclone and a wet scrubber. Plant was operating at less than 50 percent of design capacity during the test. Data were provided by a local control agency. Test is unacceptable because of cyclonic and turbulent flows in the gas stream.

Table A-9. Asphalt Concrete Facility W^a

Run number	1
Date	4/13/72
Test time, minutes	60
Production rate, tons/hr	275
Stack Effluent	
Flowrate, dscfm	32,900
Flowrate, dscf/ton of product	7178
Temperature, °F	142
Water vapor, vol. %	17.1
CO ₂ , vol. %	No Orsat available
O ₂ , vol. %	No Orsat available
CO, vol. %	No Orsat available
Visible emissions, % opacity	—
Particulate emissions	
Probe and filter catch	
gr/dscf	—
gr/acf	—
lb/hr	—
lb/ton of product	—
Total catch	
gr/dscf	0.0455
gr/acf	0.0377
lb/hr	13.2
lb/ton of product	0.048

^aApproximately 320-tons/hr-design-capacity plant equipped with a cyclone and a wet fan. Production during test was 275 tons/hr. Plant operating parameters are unknown. Data were provided by a local control agency.

Table A-10. Asphalt Concrete Facility X^a

Run number	1	2
Date	1/4/73	1/4/73
Test time, minutes	unknown	unknown
Production rate, ton/hr	200	200
Stack Effluent		
Flowrate, dscfm	82,000	80,154
Flowrate, dscf/ton of product	24,600	24,046
Temperature, °F	125	125
Water vapor, vol. %	Not available	Not available
CO ₂ , vol. %	No Orsat available	
O ₂ , vol. %	No Orsat available	
CO, vol. %	No Orsat available	
Visible emissions, % opacity	10	10
Particulate emissions		
Probe and filter catch		
gr/dscf	—	—
gr/acf	—	—
lb/hr	—	—
lb/ton of product	—	—
Total catch		
gr/dscf	0.0237	0.0286
gr/acf	—	—
lb/hr	16.2	19.5
lb/ton of product	0.081	0.0975

^aPlant was equipped with two primary cyclones, a multiple wet scrubber, and a wet fan. Production during test was 200 tons/hr. Data were provided by a local control agency.

Table A-11. Asphalt Concrete Facility Y^a

Run number	1	2
Date	11/9/72	11/9/72
Test time, minutes	unknown	unknown
Production rate, tons/hr	270	?
Stack Effluent		
Flowrate, dscfm	50,200	37,200
Flowrate, dscf/ton of product	11,156	—
Temperature, °F	125	125
Water vapor, vol. %	Not available	Not available
CO ₂ , vol. %	No Orsat available	
O ₂ , vol. %	No Orsat available	
CO, vol. %	No Orsat available	
Visible emissions, % opacity	—	—
Particulate emissions		
Probe and filter catch		
gr/dscf	—	—
gr/acf	—	—
lb/hr	—	—
lb/ton of product	—	—
Total catch		
gr/dscf	0.0045	0.015
gr/acf	—	—
lb/hr	1.93	4.98
lb/ton of product	0.007	—

^aPlant was equipped with two primary cyclones (in parallel), two multiple wet scrubbers (in series), and a wet fan. Production during the test was 270 tons/hr. Data were provided by a local control agency.

Table A-12. Asphalt Concrete Facility Z^a

Run number	1
Date	11/16/71
Test time, minutes	unknown
Production rate, tons/hr	100
Stack effluent	
Flowrate, dscfm	62,175
Flowrate, dscf/ton of product	37,305
Temperature, °F	115
Water vapor, vol. %	—
CO ₂ , vol. %	1.5
O ₂ , vol. %	17.0
CO, vol. %	—
Visible emissions, % opacity	0
Particulate emissions	
Probe and filter catch	
gr/dscf	—
gr/acf	—
lb/hr	—
lb/ton of product	—
Total catch	
gr/dscf	0.0217
gr/acf	—
lb/hr	11.56
lb/ton of product	0.1156

^aPlant was equipped with a large-diameter primary cyclone, three wet scrubbers (in series), and a wet fan. Production during the test was 100 tons/hr. Data were provided by a local control agency.

Table A-13. Asphalt Concrete Facility AA^a

Run number	1	2
Date	7/16/71	7/19/71
Test time, minutes	unknown	unknown
Production rate, tons/hr	250	250
Stack Effluent		
Flowrate, dscfm	38,719	34,673
Flowrate, dscf/ton of product	9293	8322
Temperature, °F	135	135
Water vapor, vol. %	unknown	unknown
CO ₂ , vol. %	2.5	3.0
O ₂ , vol. %	—	—
CO, vol. %	—	—
Visible emissions, % opacity	< 5	< 5
Particulate emissions		
Probe and filter catch		
gr/dscf	—	—
gr/acf	—	—
lb/hr	—	—
lb/ton of product	—	—
Total catch		
gr/dscf	0.011	0.004
gr/acf	—	—
lb/hr	3.48	1.07
lb/ton of product	0.014	0.004

^aPlant's design capacity is 250 tons/hr. Plant was equipped with a cyclone, three wet scrubbers (in series), and a wet fan. Production during the test was at maximum capacity. Data were provided by a local control agency.

Table A-14. Asphalt Concrete Facility BB^a

Run number	1	2	3	Average
Date	3/5/73	3/5/73	3/5/73	
Test time, minutes	unknown	unknown	unknown	—
Production rate, tons/hr	144	144	144	144
Stack Effluent				
Flowrate, dscfm	15,156	14,710	15,974	15,280
Flowrate, dscf/ton of product	6315	6129	6656	6367
Temperature, °F	131	138	140	136
Water vapor, vol. %	23.7	29.5	24.6	25.9
CO ₂ , vol. %	No Orsat available			
O ₂ , vol. %	No Orsat available			
CO, vol. %	No Orsat available			
Visible emissions, % opacity	—	—	—	—
Particulate emissions				
Probe and filter catch				
gr/dscf	0.0324	0.0465	0.0549	0.0446
gr/acf	—	—	—	—
lb/hr	4.21	5.86	7.52	5.86
lb/ton of product	0.0293	0.0408	0.0523	0.0408
Total catch				
gr/dscf	—	—	—	—
gr/acf	—	—	—	—
lb/hr	—	—	—	—
lb/ton of product	—	—	—	—

^aPlant was equipped with a skimmer for primary control, a wet pre-scrubber, a wet fan, and a wet cyclonic scrubber. Production during the test was 144 tons/hr. Data were provided by commentator number 11.

Table A-15. Asphalt Facility CC^a

Run Number	1
Date	4/6/72
Test time, minutes	unknown
Production rate, tons/hr	200
Stack Effluent	
Flowrate, dscfm	29,479
Flowrate, dscf/ton of product	8844
Temperature, °F	120
Water Vapor, Vol. %	—
CO ₂ , vol. %	No Orsat available
O ₂ , Vol. %	No Orsat available
CO, vol. %	No Orsat available
Visible emissions, % opacity	—
Particulate emissions	
Probe and filter catch	
gr/dscf	—
gr/acf	—
lb/hr	—
lb/ton of product	—
Total catch	
gr/dscf	0.047
gr/acf	—
lb/hr	11.8
lb/ton of product	0.059

^aGas-fired, 200-tons/hr-design-capacity plant equipped with a cyclone and three wet scrubbers installed in series. Data were provided by a local control agency.

Table A-16. Asphalt Concrete Facility DD^a

Run number	1	2	3
Date	12/19/72	12/19/72	12/20/72
Test time, minutes	60	60	60
Production rate, tons/hr	253	253	253
Stack Effluent			
Flow rate, dscfm	27,800	27,800	26,100
Flow rate, dscf/ton of product	6,593	6,593	6,190
Temperature, °F	155	155	160
Water vapor, vol. %	32.0	30.5	32.8
CO ₂ , vol. %	4.0	4.0	4.4
O ₂ , vol. %	14.3	14.2	10.4
CO, vol. %	0.9	0.8	2.2
Visible emissions, % opacity	-	-	-
Particulate emissions			
Probe and filter catch			
gr/dscf	0.061	0.059	0.106
gr/acf	-	-	-
lb/hr	14.5	14.1	23.7
lb/ton of product	0.057	0.056	0.094
Total catch			
gr/dscf	0.062	0.060	0.107
gr/acf	-	-	-
lb/hr	14.8	14.3	23.9
lb/ton of product	0.058	0.057	0.094

^aGas-fired plant equipped with a cyclone, a wet cyclone, and a wet fan. Production rate during the test period was 253 tons/hr. Data were provided by a State control agency.

Table A-17. Asphalt Concrete Facility EE^a

Run number	1	2	3
Date	10/6/72	10/6/72	10/6/72
Test time, minutes	42.5	28	50
Production rate, tons/hr	150	150	150
Stack effluent			
Flow rate, dscfm	18,420	18,420	18,420
Flow rate, dscf/ton of product	7,368	7,368	7,368
Temperature, °F	125	125	125
Water vapor, vol. %	16.8	17.6	18.5
CO ₂ , vol. %	2.6	2.6	2.6
O ₂ , vol. %	17.0	17.0	17.0
CO, vol. %	<0.1	<0.1	<0.1
Visible emissions, % opacity	-	-	-
Particulate emissions			
Probe and filter catch			
gr/dscf	0.098	0.117	0.131
gr/acf	-	-	-
lb/hr	15.5	18.5	20.7
lb/ton of product	0.103	0.123	0.138
Total catch			
gr/dscf	0.099	0.122	0.134
gr/acf	-	-	-
lb/hr	15.6	19.3	21.2
lb/ton of product	0.104	0.129	0.141

^aGas-fired plant equipped with a cyclone, a wet fan, and a low-energy scrubber. Production during the test was 150 tons/hr. Data were provided by a State control agency.

Table A-18. Asphalt Concrete Facility FF^a

Run number	1	2	3
Date	11/14/72	11/14/72	11/14/72
Test time, minutes	46.4	48.2	17.3
Production rate, tons/hr	106	106	-
Stack effluent			
Flow rate, dscfm	15,300	15,900	15,900
Flow rate, dscf/ton of product	8,660	9,000	-
Temperature, °F	112	120	120
Water vapor, vol. %	16.5	21.8	22.6
CO ₂ , vol. %	2.4	2.4	3.0
O ₂ , vol. %	16.6	16.6	16.2
CO, vol. %	<0.1	<0.1	0.2
Visible emissions, % opacity	-	-	-
Particulate emissions			
Probe and filter catch			
gr/dscf	0.100	0.093	0.121
gr/acf	-	-	-
lb/hr	13.1	12.7	16.5
lb/ton of product	0.124	0.120	-
Total catch			
gr/dscf	0.103	0.100	0.124
gr/acf	-	-	-
lb/hr	13.5	13.6	16.9
lb/ton of product	0.127	0.128	-

^aGas-fired plant equipped with a cyclone and a wet scrubber. Production during test was 106 tons/hr. Data were provided by a State control agency.

APPENDIX B. THE ECONOMIC IMPACT OF NEW SOURCE PERFORMANCE STANDARDS UPON
THE ASPHALT CONCRETE INDUSTRY

I. ECONOMIC PROFILE

A. Industry Structure

In 1970, there were 1 346 asphalt concrete firms operating an estimated 4,500 plants in the United States.⁷ Approximately one-third of the firms operated a single plant and most of the remainder operated less than five plants.

Integration of activities varies widely from firm to firm. Table B-1 shows the percentage of firms involved in activities that are supplemental to asphalt batching.

About 75 percent of the plants are permanently installed while the remainder are considered portable. Permanent plants are primarily located in urban areas where there is a continuing market for new paving and resurfacing work. Portable plants are usually involved in highway paving projects. These plants may be disassembled and relocated to shorten hauling distances as highway construction proceeds.

Plant capacities generally fall within the range of 50 to 300 tons per hour with an average capacity of 150 tons per hour. Table B-2 shows the distribution of plant capacity in 1970.

The average plant employs four persons. The trend in recent years has been toward the construction of larger plants with a greater degree of automation.

B. Production

As Figure B-1 shows, the production of asphalt concrete has increased at an annual rate of 7 percent over the last ten years. Although growth has been cyclical, it is expected that this average growth rate will approximate 5 percent in the near future.

C. Capacity

Complete capacity data for the industry is not available. The average plant operates only 1500 hours a year at an average operating capacity of 50 percent. Inclement weather, inefficiencies in truck scheduling, time consumed in relocating portable plants, and the fact that the industry operates on a project basis are factors that contribute to the low operating ratio in this industry.

D. Consumption

Table B-3 outlines the consumption of asphalt concrete by market type over the last five years. With the interstate highway system nearing completion, the percentage of the total asphalt concrete consumed by this market has fallen off in recent years. It is expected,

TABLE B-1
INTEGRATION OF COMPANY ACTIVITIES - 1970¹

<u>ACTIVITY</u>	<u>PERCENT OF COMPANIES</u>
Places (lays) asphalt concrete	86.0%
Contractor for road construction	84.0
Contractor for other construction	54.5
Own gravel pit or quarry	46.3
Produces Portland cement concrete	18.3
Distributes Liquid Asphalt	18.1

¹Based on a sample of 387 of the 1846 companies operating in 1970 (Ref. 7)

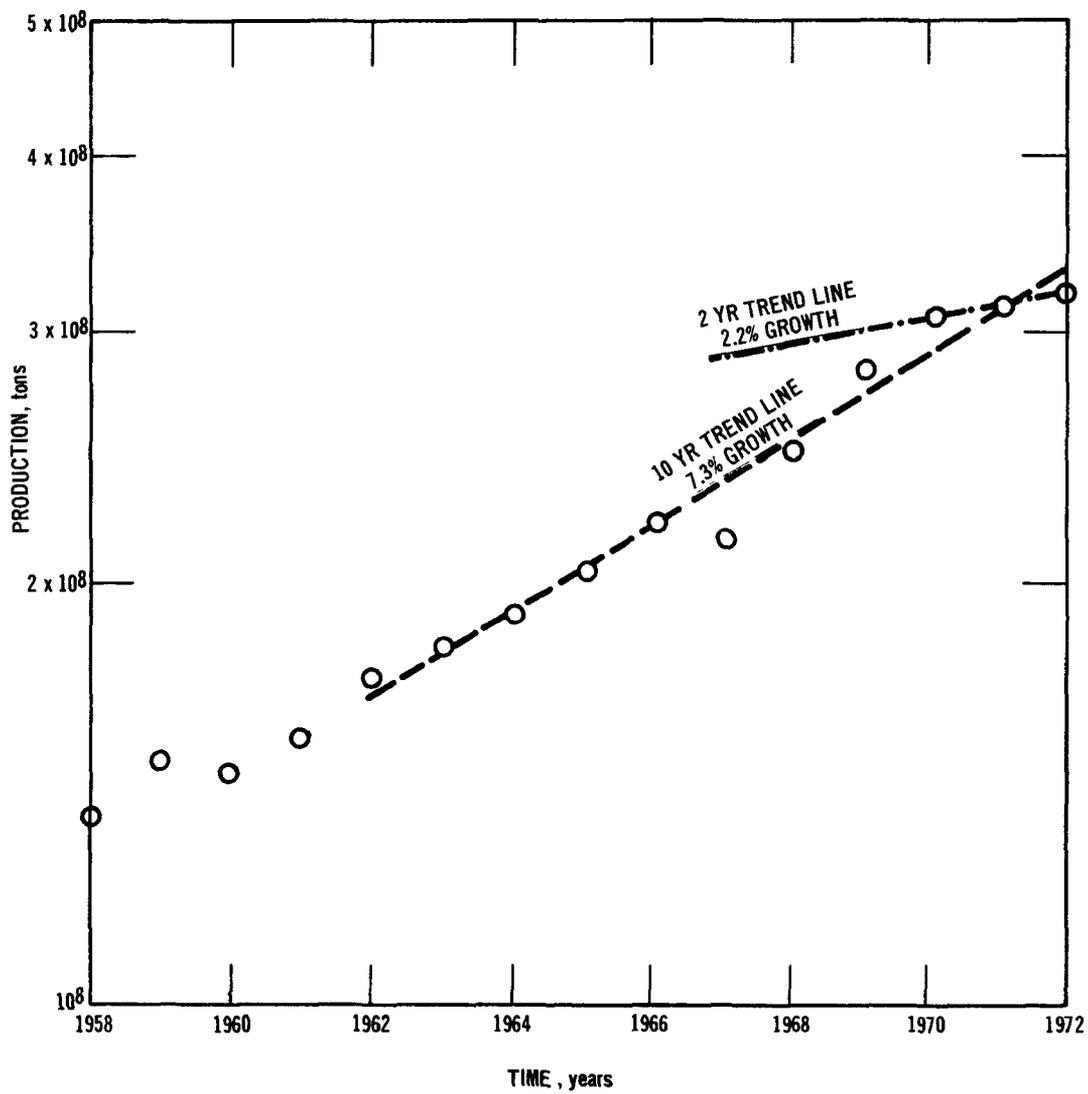


Figure B-1. Asphalt concrete production, 1958-1972 (source: NAPA).

TABLE B-2
DISTRIBUTION OF PLANT CAPACITY IN 1970¹

<u>CAPACITY (Tons/Hour)</u>	<u>PERCENT OF PLANTS</u>
less than 120	15.5%
120-239	67.2
240-299	10.6
300 or greater	6.7
	<u>100.0</u>

¹Based on a sample of 1025 of the 4450 plants operating in 1970 (Ref. 7).

TABLE B-3

CONSUMPTION OF ASPHALT CONCRETE BY MARKET TYPE

<u>Market Type</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Interstate Highways	39.8	30.2	37.6	NA	40.4
State (other than Interstate)	77.4	73.5	85.3	NA	102.6
Municipal & County	42.0	49.7	52.7	NA	74.7
Airports	6.7	6.5	10.0	NA	12.4
Private & Commercial	39.8	49.7	60.2	NA	74.7
Other	15.4	6.5	5.0	NA	6.2
TOTAL	<u>221.1</u>	<u>216.1</u>	<u>250.8</u>	<u>NA</u>	<u>311.0</u>

CONSUMPTION OF ASPHALT CONCRETE BY CONSTRUCTION CATEGORY

<u>Category</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
New Construction	137.1	121.0	145.5	NA	158.6
Resurfacing	84.0	95.1	105.3	NA	152.4
TOTAL	<u>221.1</u>	<u>216.1</u>	<u>250.8</u>	<u>NA</u>	<u>311.0</u>

Source: Ref. 7

however, that the maintenance of the interstate system will keep the absolute consumption of asphalt concrete by this market at about its current level.

While the interstate consumption has leveled off, growth in other markets (especially municipal and country roads and private and commercial projects) has been very strong and this trend is expected to continue. The ratio of resurfacing work to new construction is another significant change in market-mix that has been occurring in recent years. As Table B-3 shows, resurfacing has grown from 38 percent of the market in 1966 to 49 percent in 1970 and this pattern is also expected to continue.

E. Prices

A recent ten state survey showed asphalt concrete prices at approximately \$8/ton. However, there is wide variation on either side of this figure.

F. New Units

As previously mentioned, plants constructed recently have tended to be larger than older plants. Table B-4 shows the capacity distribution for a sample of new plants built since 1968. The average capacity of these plants is 240 tons per hour. By assuming a 5 percent growth rate and assuming that new plants will average 240 tons per hour in capacity at the historical operating ratio, it was estimated that about 90-100 new plants will be constructed each year over the next several years in order to meet the increased demand for asphalt concrete. In addition, the industry estimates that some 50 new plants will be built annually to replace obsolete plants. Thus, approximately 150 new plants each year would become subject to the proposed new source performance standard.

II. CONTROL COSTS

A. Introduction

A "model" plant approach has been used to evaluate the probable costs and economic impact that would occur as a result of the proposed standard. Capital investment requirements and operating statements have been approximated for plants representative of new installations

TABLE B-4
DISTRIBUTION OF CAPACITY FOR NEW PLANTS²

<u>CAPACITY (Tons/Hour)</u>	<u>PERCENT OF PLANTS</u>
less than 120	0
120-239	43.7
240-299	25.0
300 or greater	31.3
	<hr/> 100.0

²Based on a sample of 16 plants installed since 1968.

in the industry. Costs to meet various levels of air pollution control were then estimated to determine the economic impact. An effort was made to determine the difference in costs and impact for a new plant meeting the proposed standard over and above the costs and impact that would result from compliance with a typical state or local regulation.

B. Model Plants

Two model plants have been developed for cost and financial analysis. The characteristics assumed for these model plants are outlined in Table B-5:

C. Control Strategies and Costs

For each of the model plants defined above, costs were developed for three different air pollution control systems. Control Strategy 1 consists of a fabric filter and required auxiliary equipment capable of complying with the proposed standard. Control strategy 2 consists of a venturi scrubber and required auxiliary equipment (including water treatment) also designed to comply with the proposed standard. Control Strategy 3 consists of a multiple-centrifugal scrubber and required auxiliary equipment capable of complying with the process weight regulation guideline published in the Federal Register of August 14, 1971 (36 FR 15496). This regulation is less stringent than the proposed standard and is fairly representative of the type of state and local standards to which new plants are subject in the absence of the proposed standard.

The model plant control costs appear in Table B-6 and B-7. The derivation of these cost estimates is outlined below:

Control Strategy 1

The cost of purchasing and installing fabric filter control systems for the model plants were derived from a report prepared by the Industrial Gas Cleaning Institute.⁵ The actual data appearing in that report are shown in Table B-8 along with the adjustments made to the raw data to make them applicable to the model plants being considered. First, the Industrial Gas Cleaning Institute (IGCI) estimates include the cost of cyclone separators. Since these devices are normally installed for economic reasons, that cost was deducted from the IGCI

TABLE B-5

MODEL PLANT CHARACTERISTICS

	Model A	Model B
Mixer Capacity	150 Tons/Hour	300 Tons/Hour
Plant Investment (without control equipment) ¹	\$284,000	\$354,000
Annual Hours of Operation	1500 Hours	1500 Hours
Average Operating Efficiency	50%	50%
Annual Production	112,500 Tons	225,000 Tons
Average Selling Price/Ton Product	\$8.00/Ton	\$8.00/Ton
Annual Sales	\$900,009	\$1,800,000
Gas Conditions at Cyclone Outlet ²		
gas volume	25,000 ACFM	50,000 ACFM
temperature	350°F	350°F
particulate loading	1500 lb/hour	3000 lb/hour
particulate loading	7.0 gr/ACF	7.0 gr/ACF

¹From Figure B-2.

²In each case, it was assumed that the fugitive dust sources (storage hoppers, elevators, vibrating screen, and weigh hopper) would be vented along with the exhaust from the rotary kiln dryer to a cyclone separator with an efficiency of 75 percent. The cost of this device is not included as air pollution control equipment since it is used to economically return material to the process. Gas volumes were derived from Figure B-3; temperature and particulate loadings were derived from data in reference 5.

TABLE B-6 - MODEL A

Mixer Capacity = 150 Tons/Hour
 Annual Production = 112,500 Tons
 Initial Investment = \$284,000
 Fabric Filter A/C Ratio = 6.5

	Control Strategy 1 Fabric Filters		Control Strategy 2	Control Strategy 3
	W/O Dust Rec.	With Dust Rec.	Venturi Scrubber	Multi-Centrifugal Scrubber
Inlet Conditions				
Gas Volume	25,000 ACFM	25,000 ACFM	25,000 ACFM	25,000 ACFM
Temperature	350°F	350°F	350°F	350°F
Particulate Loading	1500 lb/hr	1500 lb/hr	1500 lb/hr	1500 lb/hr
Particulate Loading	7.0 GR/ACF	7.0 GR/ACF	7.0 GR/ACF	7.0 GR/ACF
Outlet Conditions				
Gas Volume	24,700 ACFM	24,700 ACFM	20,500 ACFM	20,500 ACFM
Temperature	340°F	340°F	150°F	150°F
Particulate Loading	2.8 lb/hr	2.8 lb/hr	2.3 lb/hr	39 lb/hr
Particulate Loading	0.013 GR/ACF	0.013 GR/ACF	0.013 GR/ACF	0.22 GR/ACF
Efficiency	99.8	99.8	99.3	96.9
Equipment Cost¹				
Device	38,600	38,600	11,200	9,300
Auxiliaries	9,000	18,700	16,500	12,100
Total Equipment	47,600	57,300	27,700	21,400
Installation	20,400	22,200	29,600	26,300
Total Installed Cost ¹	68,000	79,500	57,300	47,700
Annual Cost				
Labor	3,800	3,800	1,500	1,500
Materials	2,000	2,000	500	500
Utilities	2,500	2,600	5,500	3,100
Dust Disposal	2,800 ²	---	5,000 ⁴	5,000 ⁴
Recovered Material	---	(1,900) ³	---	---
Depreciation	6,800	8,000	5,700	4,800
Interest & Property				
Taxes	6,800	8,000	5,700	4,800
Total Annual Cost	24,700	22,500	24,300	19,700
¢/Ton Product	22.0¢	20.0¢	21.6¢	17.5¢
Δ ¢/Ton Product	4.5¢	2.5¢	4.1¢	--
% Additional Investment	23.9%	28.0%	20.2%	16.8%
Δ % Over Strategy 3	6.1%	9.6%	2.9%	--

NOTES

¹ Adj. by CE Index (141.8/132.2) 1971 to April 1973 without primary cyclones.

² Dust disposal @ 2.5¢/ton product (NAPA via DGC).

³ 561 tons/hr @ \$3.40 (NAPA price, all recycled).

⁴ Wet sludge disposal @ 4.5¢/ton product (NAPA via DGC).

TABLE B-7 - MODEL B

Mixer Capacity = 300 Tons/Hour
 Annual Capacity = 225,000 Tons
 Initial Investment = \$354,000
 Fabric Filter A/C Ratio = 6.5

	Control Strategy 1 Fabric Filters		Control Strategy 2	Control Strategy 3
	W/O Dust Rec	With Dust Rec	Venturi Scrubber	Multi-Centrifugal Scrubber
Inlet Conditions				
Gas Volume	50,000 ACFM	50,000 ACFM	50,000 ACFM	50,000 ACFM
Temperature	350°F	350°F	350°F	350°F
Particulate Loading	3000 lb/hr	3000 lb/hr	3000 lb/hr	3000 lb/hr
Particulate Loading	7.0 GR/ACF	7.0 GR/ACF	7.0 GR/ACF	7.0 GR/ACF
Outlet Conditions				
Gas Volume	48,200 ACFM	48,200 ACFM	41,000 ACFM	41,000 ACFM
Temperature	340°F	340°F	150°F	150°F
Particulate Loading	5.4 lb/hr	5.4 lb/hr	4.6 lb/hr	4.3 lb/hr
Particulate Loading	0.013 GR/ACF	0.013 GR/ACF	0.013 GR/ACF	0.12 GR/ACF
Efficiency	99.8	99.8	99.8	98.3
Equipment Cost¹				
Device	57,900	57,900	19,200	14,500
Auxiliaries	11,600	21,700	29,300	20,700
Total Equipment	69,500	79,600	48,500	35,200
Installation	29,200	31,100	47,600	41,400
Total Installed Cost	98,700	110,700	96,100	76,600
Annual Cost				
Labor	5,000	5,000	3,000	3,000
Materials	4,000	4,000	800	800
Utilities	5,000	5,200	10,100	5,300
Dust Disposal	5,600 ²	---	10,100 ⁴	10,100 ⁴
Recovered Material	---	(3,800) ³	---	---
Depreciation	9,900	11,100	9,600	7,700
Interest & Property Taxes	9,900	11,100	9,600	7,700
Total Annual Cost	39,400	32,600	43,200	34,600
¢/Ton Product	17.5¢	14.5¢	19.2¢	15.4¢
Δ ¢/Ton Product	2.1¢	(0.9¢)	3.8¢	--
% Additional Investment	27.9%	31.3%	27.1¢	21.6%
Δ % Over Strategy 3	5.1%	7.9%	4.5%	---

NOTES

¹Adjusted from 1971 to April 1973 using CE Index (141.8/132.2).

²Dust disposal @ 2.5¢/ton product.

³1122 tons recovered/year at \$3.40.

⁴1122 tons disposed of at 4.5¢/ton product.

estimates. Secondly, the IGCI estimated costs for portable equipment which they claim increases costs by about 10 percent over stationary equipment. Since the model plants under consideration are stationary, 10 percent was deducted from each cost element to discount the portability aspect. The adjusted costs were then plotted against gas volume (see Figure B-4) and installed costs of \$68,000 for Model A and \$98,700 for Model B were obtained from this plot.

These estimates were compared with actual expenditures for fabric filter control systems reported by asphalt batching plants. The data received from the plants was updated to 1973 dollars using Reference 1 and plotted against gas volume (see Figure B-5). As this plot shows, the costs estimated for the model plants agree quite closely with the data reported from actual installations.

Annual expenses for labor, materials, and electricity were estimated from data in the Handbook of Fabric Filter Technology⁴. The following cost factors were applied:

	<u>Model A</u>	<u>Model B</u>
labor	\$.15/CFM-YR	\$.10/CFM-YR
materials	.08/CFM-YR	.08/CFM-YR
utilities	.10/CFM-YR	.10/CFM-YR

It was assumed that all of the material collected by the fabric filter would be returned to the process as mineral filler. The value of this material was calculated as the product of the collection rate (1500 lbs/hr for Model A; 3000 lbs/hr for Model B), the annual hours of operation (1500 hours), the average operating efficiency (50 percent), and an assumed price for mineral filler (\$3.40 per ton). The value of this material was treated as a credit against annual expenses.

Annual depreciation was taken to be straight-line over the expected life of the plant (10 years). Annual interest on the investment was assumed to be 8 percent and annual property taxes were assumed to be 2 percent of the initial investment.

These annual expenses and credits were summed and divided by the annual production to arrive at net control costs of \$0.20 per ton of product for Model A and \$0.15 per ton of product for Model B.

Control Strategies 2 and 3

Purchase and installation costs for the wet scrubbing systems were also obtained from the IGCI report⁵. The data appearing in that report are presented in Table B-9. This data was adjusted against gas volume, and the installed costs of wet scrubbing systems for the model plants are presented in Table B-10.

The capital costs of sludge ponds were estimated separately and added to the installed costs of the wet scrubbing system in Table B-10. It was assumed that the following storage capacities were required:

	<u>Venturi Scrubber</u>	<u>Multi-Centrifugal Scrubber</u>
Model A	20,000 gallons	5,000 gallons
Model B	45,000 gallons	11,000 gallons

The settling pond capital costs were estimated from two references^{3,11} and it was assumed that one-half of this cost was for equipment purchase and one-half for installation.

Annual expenses for labor, materials, and utilities were estimated from data in Control Techniques for Particulate Air Pollutants⁹. The following cost factors were applied:

labor:	\$.06/CFM-YR
electricity:	\$.015/KWH
water:	\$.50/1000 Gallons

The power requirements assumed for the wet scrubbing systems (fans and pumps) are as follows:

	<u>Venturi Scrubber</u>	<u>Multi-Centrifugal Scrubber</u>
Model A	250 H.P.	150 H.P.
Model B	400 H.P.	250 H.P.

It was assumed that both plants would operate 1500 hours per year and that make-up water would amount to 10 percent of the recirculation rate (15 gallons/1000 CF for venturi scrubbers; 5 gal/1000 CF for multi-centrifugal scrubbers).

Periodic dredging of the settling pond and final disposal of the material collected by the scrubber is required when wet scrubbing systems are used. Industry sources state this cost runs about 4.5¢/ton of production.

Annual depreciation, interest, and property taxes were estimated under the same assumptions described for the fabric filter calculations.

The annual control costs per ton of product were calculated to be \$.22 for Model A, Control Strategy 2; \$.18 for Model A, Control Strategy 3; \$.19 for Model B, Control Strategy 2; and \$.15 for Model B, Control Strategy 3.

D. Discussion

Some conclusions may be drawn from the costs estimates appearing in Tables B-6 and B-7. Either the fabric filter or the venturi scrubber will enable a new plant to comply with the proposed standard and neither the capital costs nor the annualized costs for these devices appear to be significantly different. Therefore, local conditions at the individual plant site will probably dictate the choice of control method.

The costs of a fabric filter system should be compared to the costs of a multiple-centrifugal scrubbing system (capable of achieving a typical state or local regulation) in order to measure the incremental costs that the proposed standard would impose upon a new plant. As Table B-6 shows, a fabric filter system for the smaller plant would necessitate 10 percent additional capital investment over a medium efficiency scrubber. On an annualized basis, however, the incremental cost amounts to only 3 cents per ton of product which is not significant.

The incremental investment required for the larger plant (Table B-7) is 8 percent and the annual costs are slightly less for the fabric filter than for the medium-efficiency scrubber. Capital and annualized costs apparently increase more rapidly for the scrubber than for the fabric filter as plant capacity is increased. This suggests that large

plants might find it economical to install fabric filters rather than scrubbers just to meet existing state and local regulations. Indeed, among the larger plants installed in recent years, the fabric filter has been by far the most common control system selected. It is important to note again that new plants are expected to be, on the average, much larger than the average existing plants and many of these would undoubtedly install fabric filter collectors even in the absence of the proposed standard.

III. ECONOMIC IMPACT

The economic impact can be measured by considering the incremental cost of meeting the proposed standard compared to the costs incurred in the absence of the proposed standard. Since EPA has promulgated ambient air quality standards for particulates, each state has established emission standards for this pollutant and any new plant must comply. Most state standards can be met by using a low-energy scrubber as detailed under Control Strategy 3 in Tables B-6 and B-7. The difference in cost between this strategy and Control Strategies 1 or 2 represents the incremental cost of control. Since many states have tighter regulations, the low-energy scrubber problem reflects the "worst case" situation.

On an annualized cost basis, it appears that the fabric filter is the lesser-cost device for both plant sizes. The key element is that the fabric filter collects the particulate material in a useful form while the material collected by the scrubber must be disposed of at the operator's expense. Thus, it may be assumed that most new plants would favor a fabric filter control system when selecting a control system to comply with the performance standard. This assumption is further substantiated by the trend of control equipment installed since 1968. Information was supplied by industry which showed that about 3 percent of the collectors installed in 1968 were fabric filters, while about 65 percent of the collectors installed in 1972 were fabric filters.

The installation of a fabric filter on the smaller plant necessitates an increase in capital investment of 28 percent over the base-plant investment. However, the incremental investment required to equip the plant with a fabric filter rather than a low-energy scrubber (to comply with most state standards) is about 10 percent. Similarly for the larger plant, the additional capital investment required by the fabric filter over the base-plant investment is 31 percent, while the incremental investment over equipping the plant with a low-energy scrubber is 8 percent.

It is not possible to say that, in all situations, the proposed standard will not create any additional financing problems. It is our judgment, though, that the incremental investment required by the proposed standard is in general not anticipated to create any serious additional financing problems for new asphalt concrete plants.

The Economics of Clean Air, 1972, concluded that asphalt concrete plants meeting state emission standards should be able to increase prices to cover the added cost of pollution control. Since the annual control cost for a new plant meeting the proposed standard closely approximates the cost for an existing plant meeting a typical state standard, our judgment was that a new plant would not be placed at a competitive disadvantage.

These judgments have been reinforced by the industry association's public comments that were submitted to EPA on July 24, 1973. On page 49 of their comments they stated:

The National Asphalt Pavement Association, as it has indicated on many occasions to EPA, submits that the legitimate goal of protecting the environment and reducing emissions will be achieved by the imposition of a .06 standard rather than the .031 standard. It is submitted by the industry that this will result in an improvement of the emission levels by 99.8%, and is consistent with the goal which has been stated, of 99.7% by the Environmental Protection Agency. Further, it is submitted that the reduction is achievable at a reasonable cost without unduly endangering the existence of the industry or forcing the use of other alternative products. Thus, it is submitted that it is important that the standard be .06 and not .031.

.It is important that it be recognized that if the standard is .06, the equipment which will be required to be purchased will be either a venturi scrubber with a minimum 20-inch pressure drop or a baghouse with a 6-to-1 air-to-cloth ratio. It is submitted that there will be a significant improvement in the environment with an .06 standard. The .06 standard will further require that the plants be kept in good operating repair and condition or they will fail to meet the .06 standard. A .06 standard will avoid the problems of the size and shape of the particulates and also other problems which cannot be answered at the present time.

NAPA's conclusion is that the cost for a venturi scrubber with a 20-inch pressure drop or a baghouse with a 6-to-1 air-to-cloth ratio is reasonable. It is EPA's contention this equipment will achieve our proposed standard. Thus, NAPA's conclusion that cost for this type of equipment is reasonable reinforces our judgment that the cost to meet the proposed standard is reasonable.

TABLE B-8

ESTIMATED CAPITAL COSTS AND ADJUSTMENTS FOR FABRIC FILTERS
(Source: Ref. 5)

	Plant Size	
	<u>30,600 ACFM</u>	<u>42,900 ACFM</u>
Gas Cleaning Device Cost (IGCI Report)	\$49,901	\$61,160
Adjustment for cyclone	(4,800)	(6,600)
Adjustment for portability	<u>(4,510)</u>	<u>(5,456)</u>
Adjusted Gas Cleaning Device Cost	\$40,591	\$49,104
Auxiliaries Cost (IGCI report)	\$10,046	\$11,544
Adjustment for portability	<u>(1,005)</u>	<u>(1,154)</u>
Adjusted Auxiliaries Cost	\$ 9,041	\$10,390
Installation Cost (IGCI report)	\$23,687	\$28,485
Adjustment for portability	<u>(2,369)</u>	<u>(2,849)</u>
Adjusted Installation Cost	\$21,318	\$25,636
TOTAL COST	\$70,950	\$85,130
C.E. Plant Cost Index (141.8/132.2)	1.073	1.073
TOTAL ADJUSTED COST	\$76,129	\$91,344

TABLE B-9

ESTIMATES CAPITAL COSTS OF WET SCRUBBERS

(Source: Ref. 5)

	<u>PLANT SIZE</u>	
	<u>30,600 ACFM</u>	<u>42,900 ACFM</u>
Control Strategy 2		
Gas Cleaning Device Cost	\$12,181	\$15,930
Auxiliaries Cost	13,062	18,210
Installation Cost	27,360	33,571
Total Cost	<u>\$52,603</u>	<u>\$67,711</u>
CE Index (141.8/132.2)	<u>x1.073</u>	<u>x1.073</u>
(Scale Exponent is 0.75)	\$56,443	\$72,654
Control Strategy 3		
Gas Cleaning Device Cost	\$ 9,975	\$12,229
Auxiliaries Cost	11,013	14,539
Installation Cost	26,157	31,934
Total Cost	<u>\$47,145</u>	<u>\$58,702</u>
CE Index (141.8/132.2)	<u>x1.073</u>	<u>x1.073</u>
Total Adjusted Cost	\$50,587	\$62,987
(Scale Exponent is 0.65)		

TABLE B-10

ESTIMATED CAPITAL COSTS OF WET SCRUBBERS

(ADJUSTED TO EPA MODEL PLANT SIZE)

	<u>PLANT SIZE</u>	
	<u>25,000 ACFM</u>	<u>50,000 ACFM</u>
Control Strategy 2		
Gas Cleaning Device Cost	\$11,200	\$19,200
Auxiliaries Cost	12,000	22,000
Installation Cost	25,200	40,400
Sludge Pond Cost Plus Inst.	8,900	14,500
Total	<u>\$57,300</u>	<u>\$96,100</u>
Control Strategy 3		
Gas Cleaning Device Cost	\$ 9,300	\$14,500
Auxiliaries Cost	10,100	17,500
Installation Cost	24,400	38,300
Sludge Pond Cost Plus Inst.	3,900	6,300
Total	<u>47,700</u>	<u>76,600</u>

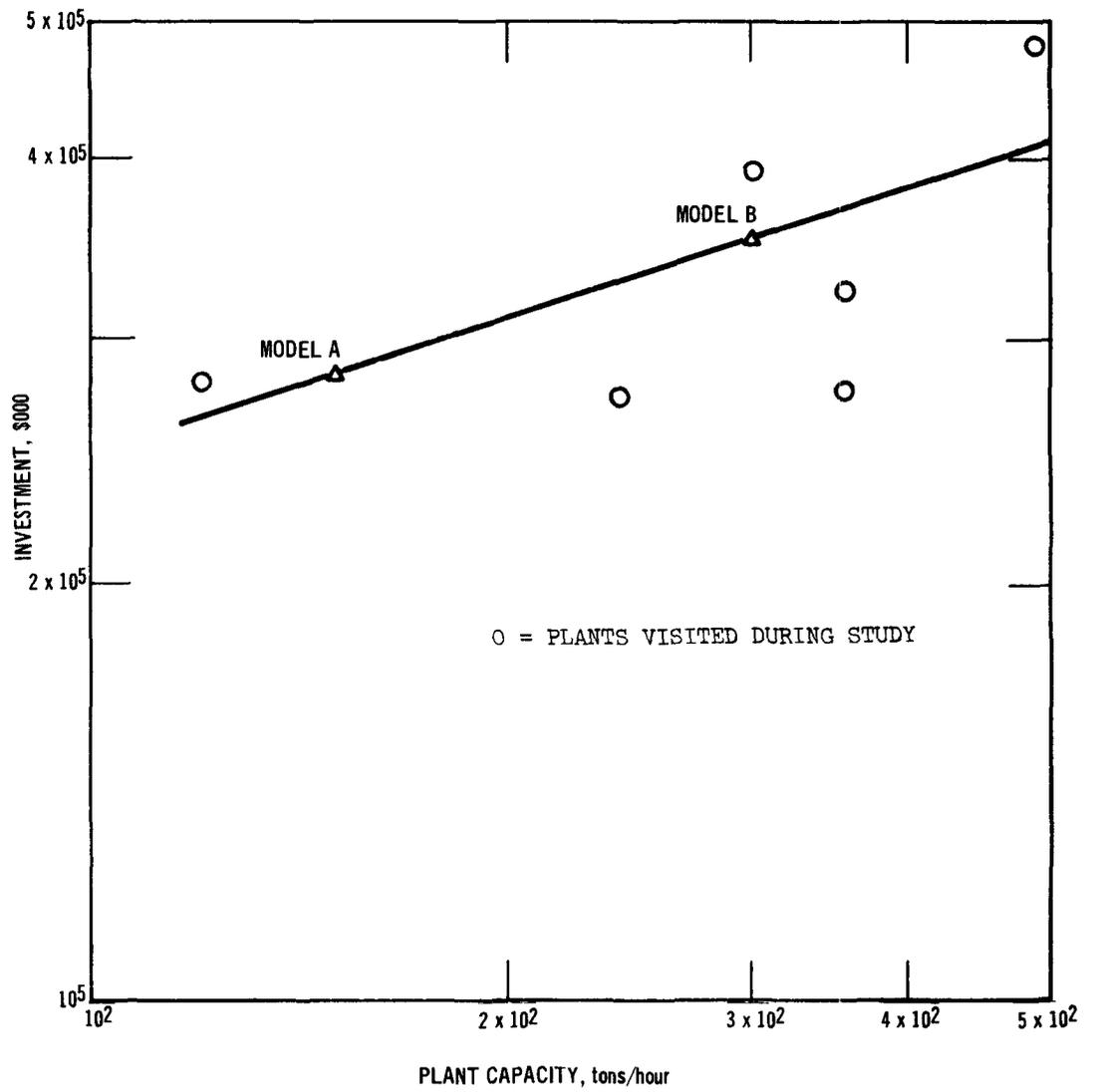


Figure B-2. Base plant investment versus plant capacity (adjusted to April 1973 dollars).

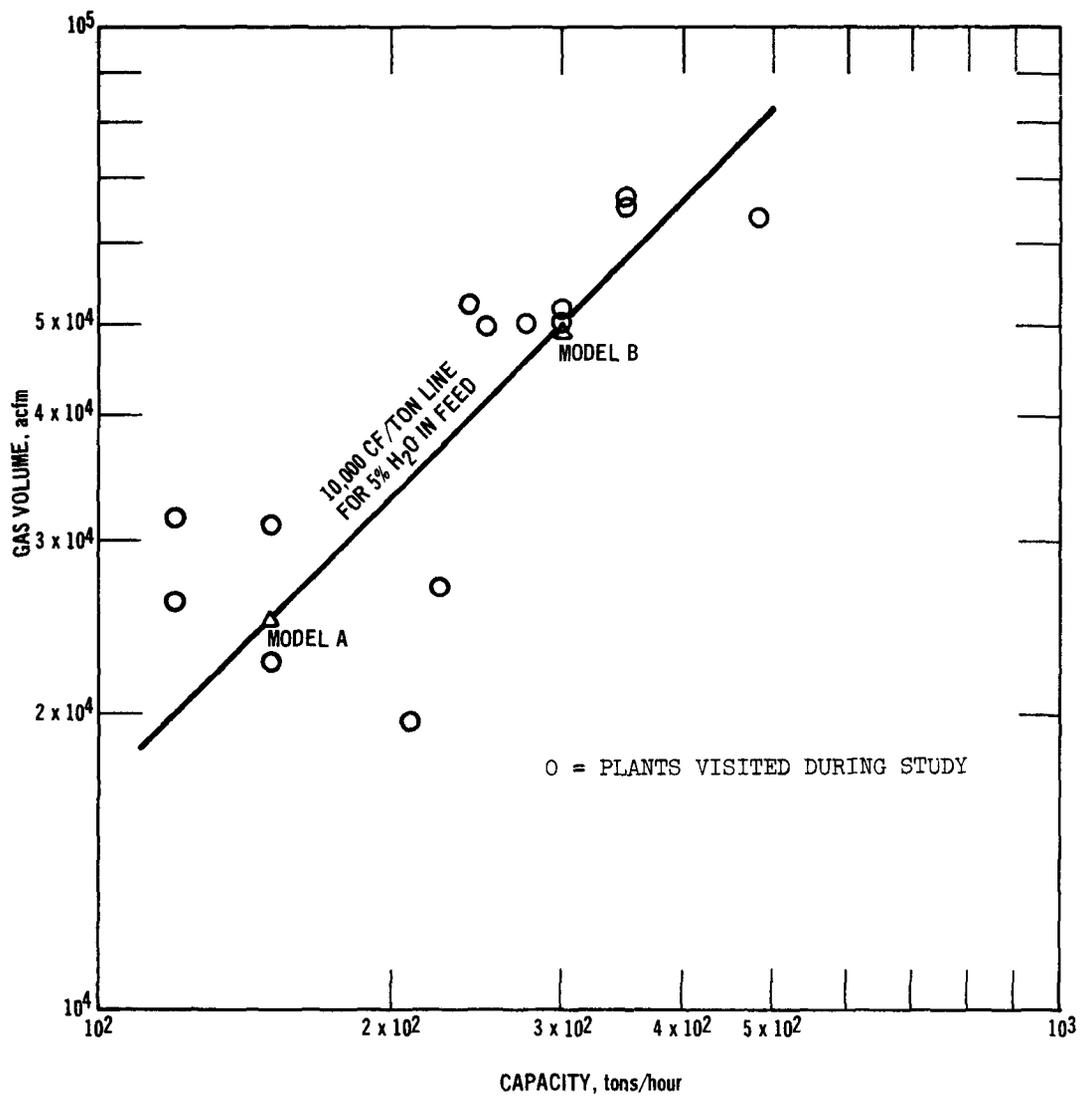


Figure 3-3. Gas volume versus plant capacity. (Source: Asphalt concrete plants visited during study.)

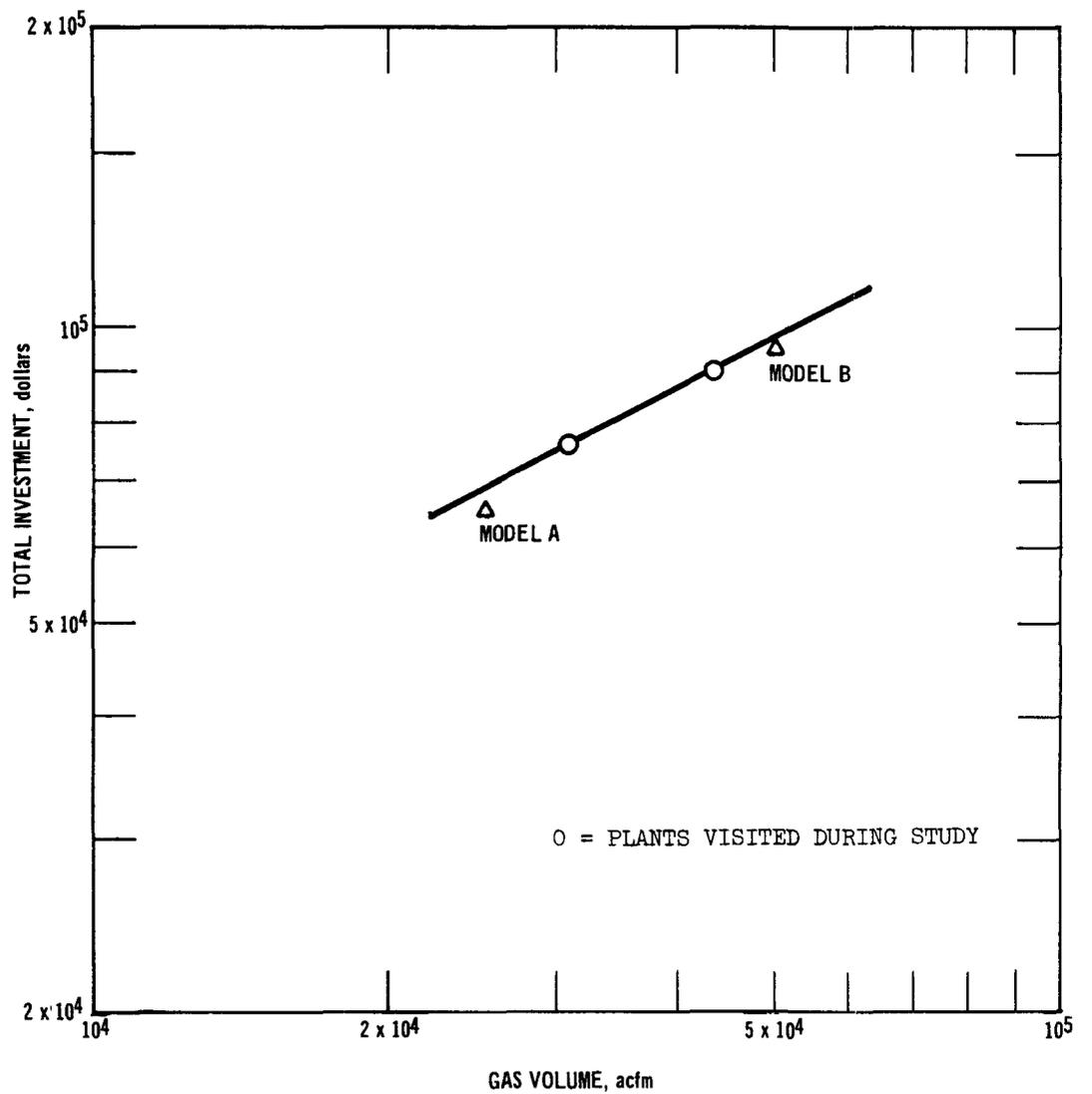


Figure B-4. Estimated capital costs of fabric filters versus gas volume. (Source: Adjusted data from IGCI report.)

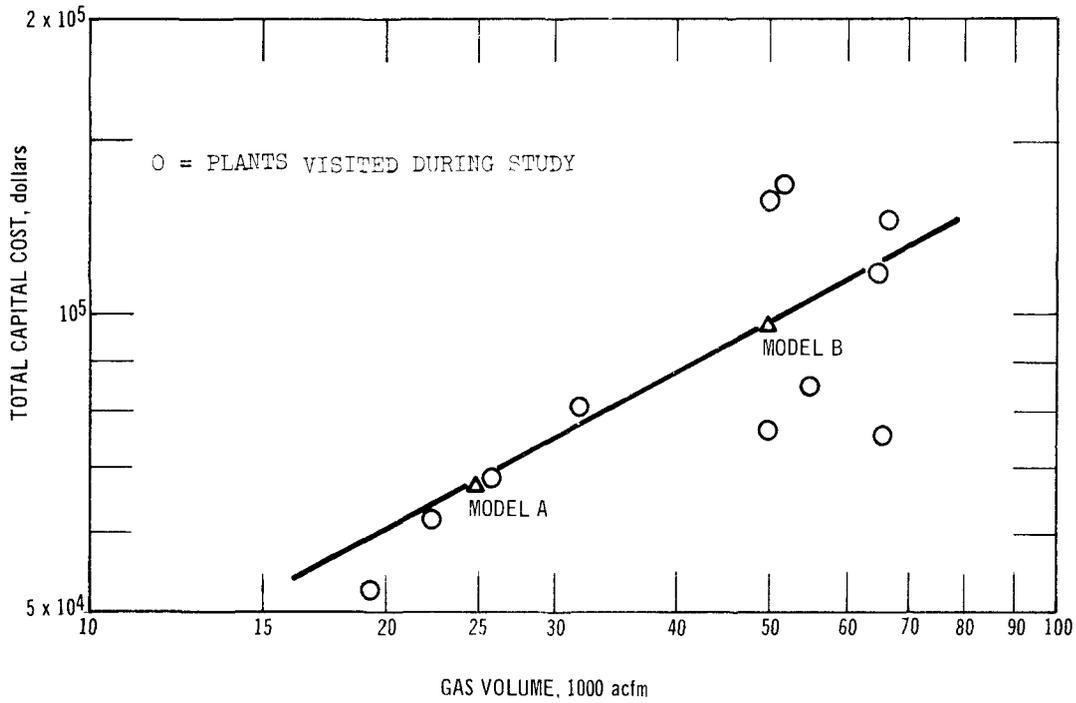


Figure B-5. Reported capital costs of fabric filters versus gas volume. (Source: Asphalt batching plants visited during study; costs adjusted to 1973 dollars by index in Ref. 1.)

REFERENCES

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2. Environmental Engineering, "Background Information for the Establishment of National Standards of Performance for New Sources", 1971.
3. Bituminous Construction Handbook, 1970, Barber, Greene Company.
4. GCA Corporation, Handbook of Fabric Filter Technology, 1970.
5. Industrial Gas Cleaning Institute, Air Pollution Control Technology and Costs in Nine Selected Areas, Special Interim Report, 1971.
6. Journal of the Air Pollution Control Association, "Air Pollution Control Practices for Hot-mix Asphalt Paving Batch Plants", 1969.
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APPENDIX C. THE ECONOMIC IMPACT OF NEW SOURCE PERFORMANCE
STANDARDS UPON PETROLEUM REFINERIES

I. INTRODUCTION

The proposed new source performance standards pertaining to both petroleum refinery fluid catalytic cracking units and the burning of gaseous refinery fuels generate control costs that are higher on a per-barrel basis for the smaller refineries than for the larger refineries. This disparity in per-barrel control costs raises the question of the degree of economic impact upon the smaller refiners relative to the larger refiners. The complexity of the situation is compounded by the fact that new and modified refineries will also be subject to costs for controlling water pollution and costs to remove lead from gasoline as well as the costs for controlling air pollutants. These environmental cost pressures, coupled with potential domestic shortages of petroleum products, necessitated a study of the economic impact of projected pollution abatement requirements upon the domestic petroleum refining industry, with particular emphasis being given to the small refiner. It should be noted that normal economies of scale in the refining industry appear to preclude any new small refineries. Modifications, however, to existing small refineries are always a possibility. Since control costs for new large refineries do not appear to be large enough to adversely impact upon construction of new large refineries, this analysis should mainly be interpreted in light of the effects of the proposed new source performance standards upon modified small refineries.

II. CONTROL COSTS - NEW SOURCE PERFORMANCE STANDARDS ONLY

Annualized control costs, on a per-barrel basis, for compliance with the proposed new source performance standards will vary inversely with refinery size. This is due to the fact that total control costs for control of the fluid catalytic cracking unit and the refinery fuel gas hydrogen sulfide emissions do not decrease as rapidly as the decrease in refinery size. Table C-1 illustrates this situation.

TABLE C-1. PETROLEUM REFINERY CONTROL COSTS
(New Source Performance Standards Only)

Refinery Size	<u>Capital Costs</u>			<u>Annualized Costs</u>			
	<u>Fuel Gas</u>	<u>Cat. Cracker</u>	<u>Total</u>	<u>Fuel Gas</u>	<u>Cat. Cracker</u>	<u>Total</u>	
5,000 BCD	\$560M	0*	\$560M	\$185M	0*	\$185M	10¢/bbl
10,000	590	350	940	200	67	267	7¢
50,000	900	785	1685	365	147	512	3¢
100,000	1200	1150	2350	530	213	743	2¢

*Refinery too small to have a catalytic cracking unit.

The basic assumptions underlying Table C-1 are as follows:

1. Capital costs represent installed equipment.
2. Annualized costs include operating and maintenance costs plus capital charges at 15.7 percent of capital.
3. The fuel gas control system consists of an amine treating unit and a 3-stage Claus sulfur plant.
4. The catalytic cracker control system consists of an electrostatic precipitator. The precipitator is designed for 300 square feet of collection plate area per thousand actual cubic feet of gas per minute.
5. The catalytic cracking unit is sized at 30 percent of the total refinery size.
6. Annualized costs do not include any credits for recovered material.
7. The sulfur content of the crude oil being processed is 0.5 percent.
8. The percentage of sulfur in the crude oil that reverts to the fuel gas is 45 percent.

Table C-1 shows that annualized control costs for a 5,000 barrel per calendar day (BCD) refinery amount to 10¢ per barrel of finished product whereas the annualized control costs for a 100,000 BCD refinery are 2¢ per barrel of finished product. The smaller refiner, therefore, is experiencing an 8¢/bbl cost penalty relative to the larger refiner.

It should be noted that Table C-1 does not take into account those production situations in which a refiner would remove the hydrogen sulfide from the fuel gas even in the absence of emission control regulations. In cases like this the cost of hydrogen sulfide removal would not be considered an emission control cost and the impact of the regulations upon the refiner would be decreased considerably.

III. CONTROL COSTS - TOTAL CONTROL REQUIREMENTS

The costs for control of air pollutant emissions from new source petroleum refineries are not the only environmental costs being incurred in the petroleum industry. In addition, the domestic refining industry is facing costs for control of water pollution and costs for removing lead from gasoline. These costs will also tend to impact more severely upon the small refiner than the larger refiner. Table C-2 presents an estimate of the per-barrel annualized costs for control of air and water emissions and for removing lead from gasoline.

TABLE C-2. ANNUALIZED CONTROL COSTS

(Total Environmental Requirements)

<u>Refinery Size</u>	<u>Air</u>	<u>Water</u>	<u>Lead</u>	<u>Total</u>
5,000 BCD	10¢/bbl	17	12	39¢/bbl
10,000	7	8	6	21
50,000	3	4	2	9
100,000	2	3	2	7

It should be noted from Table C-2 that total control costs for air emission reductions, water pollution abatement, and lead removal costs again are greatest for smaller refiners. Total control costs for an average 5,000 BCD refiner at 39¢/bbl are 32¢/bbl higher than the control costs being faced by the average 100,000 BCD refiner.

The above summary of water pollution control costs and the costs of removing lead from gasoline are based on the following assumptions:

1. Water pollution control costs represent a preliminary EPA estimate of costs incurred through the use of best practicable technology in existing plants by 1977. Costs for new source compliance with the effluent guidelines will generally be less than the cost of compliance in existing plants since new sources will generally be designed in such a fashion that water treatment costs are minimized. Therefore, the costs for control of water pollution shown in Table C-2 above approximate a maximum estimate of the costs to be incurred in a new facility. The use of best available control technology by 1983 is expected to increase the costs for existing plants. For example, a 25,000 BCD refinery that would incur best practicable control costs of 5¢/bbl would incur best available control costs of 12.5¢/bbl. An important point to note with regard to the above water pollution control costs is that the costs apply to the treatment of an average water flow for a given size refinery. Plants with water usage rates in excess of the average amount assumed in the table above will incur costs higher than the costs assumed above. In some cases these additional treatment costs can be substantial. The extreme variability among existing petroleum refineries makes analysis of this point quite difficult.
2. Lead removal costs based upon an estimate of refining costs prepared by Bonner and Moore of approximately 3.6 cents per barrel of gasoline for large refiners and 12.0-24.6 cents per barrel for smaller refiners. It should be noted that the above costs assume that modern processing facilities are available at the refinery. If this is not the case, then total costs for refining and distribution costs could increase by an additional 55 cents per barrel of gasoline.

3. Lead removal costs based upon conversion of 50 percent of the crude oil input to gasoline. Higher conversion factors would increase the cost impact of the lead removal regulation whereas lower conversions would lessen the overall economic burden.

IV. ECONOMIC IMPACT - TOTAL CONTROL REQUIREMENTS

The profit margins of small domestic refiners are believed to vary widely due to numerous factors such as location relative to both crude supplies and finished product markets, individual operating economies, and specialized markets. A gross estimate of average small refiner profitability is approximately 1/2¢ per gallon of product, or 21¢ per barrel. Comparing this level of profitability to the total control costs shown in the preceding table it is seen that a 5,000 BCD refinery will be placed in a position of losing 18¢/bbl and a 10,000 BCD refinery will break even after complying with the new source performance standards for air pollutant emissions, the water pollution guidelines, and the lead removal regulations. Even though a refiner with a capacity of 50,000 BCD would not be placed in a loss position due to pollution control requirements, the refinery profit margin would be cut by approximately 40 percent by the total environmental cost of 9¢/bbl. The 50,000 BCD refiner, however, is probably large enough to experience profits somewhat in excess of 21¢/bbl so that his profit after controls may be in excess of 12¢/bbl. It is apparent, therefore, that the major impact of the current environmental requirements upon the domestic petroleum refining industry will fall upon refiners that have capacities of 50,000 BCD and less.

It appears, however, that future profitability for the domestic refining industry will increase to the point where even average small refiners will not be in a loss position after compliance with environmental regulations. The mechanism that will allow this situation to occur is the Import License Fee System. This fee system, which was initiated by Presidential Proclamation 4210 (Federal Register, Vol. 38, No. 75, Thursday, April 19, 1973) is essentially a tariff system that will apply to both imported crude oil and imported finished products. The fees to be paid on imported materials will increase over time, starting in 1973 and reaching a maximum level in 1975. The fee schedule is shown in Table C-3.

TABLE C-3. FEE SCHEDULE (¢/bbl)

<u>Product</u>	<u>May 1 1973</u>	<u>Nov. 1 1973</u>	<u>May 1 1974^{1/}</u>	<u>Nov. 1 1974</u>	<u>May 1 1975</u>	<u>Nov. 1 1975</u>
Crude	10-1/2	13	15-1/2	18	21	21
Motor Gasoline	52	54-1/2	57	59-1/2	63	63
All Other Finished Products and Un- finished Oils ^{1/}	15	20	30	42	52	63

^{1/}Except ethane, propane, butanes, and asphalt.

The purpose of the fee system, as quoted in the Federal Register referred to above, is "to discourage the importation into the United States of petroleum and petroleum products in such quantities or under such circumstances as to threaten to impair the national security; to create conditions favorable, in the long range, to domestic production needed for projected national security requirements; to increase the capacity of domestic refineries and petrochemical plants to meet such requirements; and to encourage investment, exploration, and development necessary to assure such growth." Encouragement of domestic production was deemed necessary due to the increasing trend in this country to import petroleum products. A projection of domestic supply and demand that was prepared prior to the announcement of the Import License Fee System by the National Petroleum Council is presented in Table C-4.

TABLE C-4. U.S. PETROLEUM SUPPLY AND DEMAND

(Thousands of Barrels/Day)

	<u>1973</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>
Total U.S. Product Demand	17,600	19,800	22,500	26,200
Product Output ^{1/}	<u>12,725</u>	<u>13,257</u>	<u>15,115</u>	<u>16,820</u>
Excess Demand	4,875	6,543	7,435	9,380
% of Total Demand	28%	33%	33%	36%

^{1/}Output at 96-97% of total domestic refinery capacity.

It is believed that the Import License Fee System will spur domestic refinery construction but that the United States will still be a net importer of petroleum products at least through 1985. The impact of the fee system on domestic prices will be to increase finished product prices by 63¢/bbl in 1975, assuming that price controls are no longer in effect at that time. The reasoning behind this conclusion is based upon the shortage of domestic refining capacity that is projected to exist through 1985. A producer who imports finished products would be expected to raise his prices to cover the import fee. Since all refiners are operating essentially at capacity there is no incentive for a competing refiner to keep his prices low relative to the producer that imports petroleum products since he will not generate any additional sales by doing so. This means that domestic prices will rise by an amount equal to the import fee, or 63¢/bbl. Note that this mechanism will occur only in the case where domestic refineries are being utilized essentially at capacity.

The same type of mechanism may also occur in the area of crude supplies, with crude prices rising by the amount of the import fee, or 21¢/bbl. This means that domestic refining profits would increase by a net amount of 42¢/bbl. It is altogether possible, however, that domestic crude prices, particularly for the smaller, inland refiners who are in close proximity to adequate crude supplies, will not be increased by 21¢/bbl. This means that profit margins could increase by the full amount of the general finished product price increase, or 63¢/bbl. In general, then, the Import License Fee System will generate additional profits, over and above current levels, of 42-63¢/bbl for the domestic petroleum refining industry.

The additional profits generated by the Import License Fee System will allow average small refiners to comply with all environmental regulations and still have an incentive to expand their operations. The differences in control costs for the small average refiner relative to the large refiner will still exist, but with the fee system in operation the average small refiner will not be forced into a no-growth situation because of compliance with environmental regulations.

The above mechanism resulting in an industry-wide price increase of 63¢/bbl would not occur in a situation constrained by price controls as they are currently being implemented. This is due to the fact that only cost increases are allowed to be passed on as price increases and no windfall profits can be generated. Prices would increase, but not by the full margin of 63¢/bbl for all producers. Pollution control costs would be passed on in the form of price increases also, but again only on a dollar-for-dollar basis. This would mean that small refiners would be at a distinct price disadvantage relative to large refiners. Whereas in the short run the small refiner might be able to sell his output since overall industry refining capacity is constrained, there are long term problems with this type of system. Therefore, this analysis is dependent upon the assumption that price controls will be essentially removed from the domestic petroleum refining industry by 1975 so that the import fee system, or a similar system, would generate industry-wide price increases sufficient to ensure the viability of small refiners.

As mentioned previously, those existing plants with water usage rates considerably in excess of average refinery usage rates could incur water treatment costs much greater than the industry average costs. It appears possible that these costs, in addition to costs for lead removal for gasoline and compliance with state air quality regulations, could cause the closing of some small refineries. These closings, of course, would occur in the absence of any new source performance standards.

There is a situation whereby the proposed new source performance standards could adversely impact upon modified existing refineries. This situation could possibly occur as a result of a refiner being forced to add another process unit to produce an unleaded grade of gasoline. If the process

unit burned refinery fuel gas it would be subject to the proposed new source performance standards and their attendant costs. These costs could be large enough to make the modification uneconomic. If additional output was obtained as a result of the modification, however, this output could be sold at a net premium of 42-63¢/bbl under the situation created by the Import License Fee System. Since compliance costs resulting from the new source performance standards are less than this amount there appears to be no barrier to refinery modifications due to the proposed new source performance standards, even for small refiners, as long as additional output is obtained.

Returning to the situation where no additional output is obtained, it is still highly possible that there would be enough flexibility in the refinery fuel supplies so that a fuel other than refinery fuel gas could be burned in the new process unit. In this situation the new source performance standard would not apply and no adverse economic impact would be experienced by the refiner. It seems that this situation could easily be the case for those refineries that modify their facilities in order to produce unleaded gasoline.

APPENDIX D. LIST OF COMMENTATORS

<u>Comment number</u>	<u>Commentator</u>	<u>Affiliation</u>
1	Rosenstern	Koppers Co., Inc.
2	Deemer	McCarter Corp.
3	Spaeth	Bulk Terminals Co.
4	Gilliland	Ideal Cement Co.
5	Sheehan	American Lung Association
6	Not a comment (determined after numbering)	
7	Wainer	Wainer Brothers, Inc.
8	Soares	White's Mines, Inc.
9	Feldman	Lake-River Terminals
10	Moore	Moore Brothers Construction
11	Todd	Percy Todd Mfg., Co.
12	Holland	Holland Construction
13	Fleischman	County Asphalt Co.
14	Plummer	E.D. Plummer Sons
15	Nespeco	National Oil Fuel Inst.
16	Simmons	Flatiron Paving
17	Simmons	Eastern Industries
18	Madison	Lehman-Roberts Co.
19	Bury	Midwest Asphalt Corp.
20	Vanderlinden	Midstate Contractors, Inc.
21	Moore	Associated General Contractors
22	Schofield	Gen. Am. Transportation Corp.
23	Hilton	Gulf Asphalt Corp.
24	Kelley	MacDougald-Warren, Inc.
25	Phillip	Songamo Construction
26	Wales	Henley-Lundgren Co.
27	Broce	Broce Construction Co.
28	Anthony	Washita Construction Co.
29	Busch	Ready Mix Sand & Gravel
30	Yocum	Hinkle Contracting
31	Valentine	Peter Kiewit Sons Co.
32	Smith	Pike Industries
33	Kirkby	S.E. Johnson Co.
34	Dickinson	Rust Engineering Co.
35	Johnson	Rohm and Haas Co.

APPENDIX D. LIST OF COMMENTATORS (continued)

<u>Comment number</u>	<u>Commentator</u>	<u>Affiliation</u>
36	Strain	Strain Brothers, Inc.
37	Donovan	M.F. Roach Co.
38	Hamn	Texas Asphalt Pavement Assn.
39	Fry	Miami Asphalt Corp.
40	Babler	Babler Bros., Inc.
41	MacRitchie	A.S. Langenderfer
42	Stricklin	Hadley Construction Co.
43	Chleboski	Allegheny County Health Dept.
44	Heldenfels	Heldenfels Bros.
45	Brooks	Brooks Construction Co.
46	Berry	L.A. Reynolds, Co.
47	Docter	Macclair Asphalt Co.
48	Lemon	Lemon Construction Co.
49	Kersey	Derby Refining Co.
50	Teglia	Paving Mix & Construction Co.
51	Masters	Industrial Asphalt
52	Snyder	Buffalo Slag Co.
53	Azzarelli	Azzarelli Construction Co.
54	Brooks	Brooks and McConnell
55	Richardson	Macasphalt Corp.
56	Not a comment (determined after numbering)	
57	Kowalik	Gulf Oil Co.
58	Duininck	Duininck Bros. & Gilchrist
59	Gibb	Interstate Amiesite Corp.
60	Masters	Industrial Asphalt
61	Decker	Rein, Schultz, & Dahl
62	Levine	Alabama Dept. of Public Health
63	Smith	Entropy Environmentalists, Inc.
64	Carter	Carter Co., Inc.
65	Mathis	Mago Construction Co.
66	Martinez-Lazaro	Puerto Rico Asphalt Co.
67	Acquaviva	O'Keefe Asphalt Products
68	Darnell	Washington Asphalt Co.
69	Vosti	Reed and Graham, Inc.
70	Skogsberg	North American Car Corp.
71	Chavez	Assn. de Pavimentos Asfalticos
72	Schultz	Sherwin Corp.
73	Rath	Rason Asphalt, Inc.

APPENDIX D. LIST OF COMMENTATORS (continued)

<u>Comment number</u>	<u>Commentator</u>	<u>Affiliation</u>
74	Echstenkamper	Plant Mix Asphalt Industry
75	Childress	Quapaw Company
76	Fehsenfeld	Crystal Flash Petroleum
77	O'Sullivan	N.Y. Bituminous Concrete Producer
78	Eaton	Dixie Asphalt Co.
79	Dickson	Lige Dickson Co.
80	Ashmore	Ashmore Mfg., Co.
81	Chavez	Betterroads Asphalt Corp.
82	Yarbrough	University Asphalt Co.
83	Phelan	California Asphalt Pavement Assn.
84	Frampton	Empire Construction, Inc.
85	Waller	Cornell Construction Co.
86	Knott	Johnson County Asphalt, Inc.
87	McCarthy	McCarthy Improvement Co.
88	Chadbourne	E.M. Chadbourne, Inc.
89	Eccles	Gibbons & Reed Co.
90	Mims	J.F. Cleckley & Co.
91	Clark	Manufacturing Chemists Assn.
92	Bennett	Rissler & McMurry
93	Kuhn	Columbus Bituminous Concrete Corp.
94	Huelssen	American Foundrymen's Society
95	Buschman	Texas Mid-Continent Oil & Gas Assn.
96	Sloan	Sloan Construction Co.
97	Vickers	Florida Asphalt Paving Co.
98	Weers	Westinghouse Electric Corp.
99	Robins	Georgia Office of Planning and Budget
100	Smith, Reed	Jimar Paving Co.
101	Barcklay	Washington State Assn. of County Engrs.
102	Farrell	Fitzgerald Bros. Construction Co.
103	Brower	Brower Construction Co.
104	O'Kane	Stahl Construction Co.
105	Kowalik	Gulf Oil Co.
106	Minor	Asphalt Paving Assn. of Washington
107	Bartus	Bar-Coat Blacktop Co.
108	Moore	Texas Eastern Transmission Corp.
109	Keller	Oklahoma Asphalt Pavement Assn.

APPENDIX D. LIST OF COMMENTATORS (continued)

<u>Comment number</u>	<u>Commentator</u>	<u>Affiliation</u>
110	Crim	Crim Engineering (later revised; see 206)
111	Pond	Asphalt Products Corp.
112	Keating	P.J. Keating Co.
113	Lunche	Los Angeles County APCD
114	Anony.	Conn. Bituminous Concrete Producers
115	Fitzgerald	Georgia Asphalt Pavement Assn.
116	Ruffer	Alabama Asphalt Pavement Assn.
117	Huddleston	Oregon Asphalt Pavement Assn.
118	Bowen	Mississippi Asphalt Pavement Assn.
119	Anony.	Michigan Asphalt Pavement Assn.
120	Lance	Asphalt Contractors Assn. of Fla. Inc.
121	Fulton	Flexible Pavements Inc.
122	Yeargain	Louisiana Asphalt Pavement Assn.
123	Boles	Tennessee Asphalt Pavement Assn.
124	Thelen	Wisconsin Asphalt Pavement Assn.
125	Rihm	N.Y. State Dept. of Environmental Conservation
126	Arps	Tri County Asphalt Corp.
127	Ross	Carolina Asphalt Pavement Assn.
128	Smith, Robert L.	Warren Bros. Co.
129	Maudlin	Brass & Bronze Ingot Institute
130	Derr	Wendel Kent & Co., Inc.
131	Best	A.I.Ch.E., So. Texas Section
132	Appleby	Dover Equip. & Machine Co.
133	Cromwell	HEW, NIH
134	Haddock	Crowell Constructors, Inc.
135	Cellini	Ill. Asphalt Pavement Assn.
136	Cellini	Ill. Asphalt Pavement Assn.
137	Keller	Ok. Asphalt Pavement Assn.
138	Denton	Warren Bros. Co.
139	Brenholts	Hercules Inc.
140	Hoene	Minn. Asphalt Pavement Assn.
141	Swenson	Crown Central Petroleum Corp.
142	Silverman	Salt River Project
143	Mills	Exxon Co.
144	Moore	Road Builders Inc. of Tenn.
145	Virgalitte	The Standard Slag Co.

APPENDIX D. LIST OF COMMENTATORS (continued)

<u>Comment number</u>	<u>Commentator</u>	<u>Affiliation</u>
146	Heath	Precipitation Assn. of Am., Inc.
147	Michels	Eaton Asphalt Paving Co.
148	Chapman	Beckman Instruments, Inc.
149	Maloney	Fed. Highway Assn., Dept. of Transportation
150	Ferreri	Md., Envirn. Health Administration
151	Funk	Cold River Hot Mix Corp.
152	Funk	Vermont Paving Corp.
153	Sprinkel	Vernon Asphalt Material Corp.
154	Babson	So. Carolina Asphalt Pavement Assn.
155	Kramer	Fay, Spofford & Thorndike Inc.
156	Gray	National Asphalt Pavement Assn.
157	Eidemiller	Adam Eidemiller
158	Brook	Wellsboro Asphalt Co.
159	Anony.	Burlington Asphalt Corp.
160	Anony.	Precipitation Assn. of Am., Inc.
161	Anony.	Mix Design Methods, Inc.
162	Banks	Banks Construction Co.
163	Hallman	UOP Process Division
164	Harrison	Western Oil and Gas Assn.
165	Hanagan	New Mexico Oil & Gas Assn.
166	Scott	Union Oil Co. of Calif.
167	Doyle	Peter Kiewit Sons' Co.
168	Mullins	Mullins Bros. Paving Contrs., Inc.
169	Smith & Brock	Astec Industries, Inc.
170	Proctor	Rea Construction Co.
171	Mathews	Couch Construction Co.
172	Whalen	Asphalt Materials & Paving Co., Inc.
173	Perkins	N. Mexico Envirn. Improvement Agency
174	Ballard	Phillips Petroleum Co.
175	Bury	Bury & Carlson, Inc.
176	Coppoc	Texaco, Inc.
177	Bell	JoB Construction Co.
178	Sebastian	Envirotech Corp.
179	Showers	Arizona Rock Products Assn.
180	Talbert	Agway, Inc.
181	Haxby	Shell Oil Co.
182	Ambrosius	Mid-Continent Oil & Gas Assn., Ark.-La. Div.

APPENDIX D. LIST OF COMMENTATORS (continued)

<u>Comment number</u>	<u>Commentator</u>	<u>Affiliation</u>
183	Massey	Delaware Asphalt Pavement Assn.
184	Gammelgard	Am. Petroleum Institute
185	Reeves	Reeves Construction Co.
186	Leo	Ward Pavements, Inc.
187	Dick	Trumbell Corp.
188	Keller	Bergan Asphalt Corp.
189	Oddinger	South State Inc.
190	Parker	Pan Am. Construction Co.
191	Mayes	Am. Petrofina Co of Texas
192	Goder	Joseph Goder Incinerators
193	Plaks	EPA, Metallurgical Processes Section
194	Bumford	N.H. Air Pollution Control Comm.
195	Edwards	Collier, Shannon, Rill and Edwards
196	Lindstrom	Ala. Dept. of Public Health
197	Sterling	Wayne Co. Dept. of Health, Mich.
198	Hayes	National Asphalt Pavement Assn.
199	Bulley	Wash. State Highway Comm., Dept. of Highways
200	Gartrell	TVA, Dir. Environ. Planning
201	Valentinetti	Vermont, Agency of Environ. Conservation
202	McCullough	Mt. Hope Materials Corp.
203	Shepard	Shepard Construction Co., Inc.
204	Weston	Roy F. Weston, Inc.
205	Reynolds	Atlantic Richfield Co.
206	Crim	Crim Engineering
207	Barden	Texas Air Control Board
208	Palmer	Construction Industry Manu. Assn.
209	Hampton	Rocky Mtn. Oil and Gas Assn.
210	Williams	Mid-Continent Oil & Gas Assn., Miss.-Ala. Div
211	Crosby	Ward Pavements Inc.
212	Anderson	Bethlehem Steel Corp.
213	Christy	N.J. Asphalt Pavement Assn.
214	Hale	unknown
215	Hagerman	unknown
216	Schwellenbach	unknown
217	Christy	unknown
218	Eidemiller	Adam Eidemiller, Inc.

APPENDIX D. LIST OF COMMENTATORS (continued)

<u>Comment number</u>	<u>Commentator</u>	<u>Affiliation</u>
219	Rost	Burkholder Pavement Inc.
220	Brewer	The Brewer Co. of Fla., Inc.
221	Graves	Pennzoil
222	Anony.	National Bituminous Inc.
223	Anony.	Allegheny Contracting Industries, Inc.
224	Anony.	Gallow Asphalt Co.
225	Bartholomew	Burrell Construction and Supply Co.
226	Barrett	Arawak Paving Co. Inc.
227	Babson	So. Carolina Asphalt Pavement Assn.
228	Kukish	Edison Asphalt Co.
229	Sachse	Granite Material Corp.
230	Gilliam	Scott Industries, Inc.
231	Brugman	U.S. Oil & Refining Co.
232	Clarke	Rohm & Haas Co.
233	Nelson	E.D. Etnyre & Co.
234	Kshatriya	Aqua Systems Corp.
235	Castro	Ponce Asphalt, Inc.
236	Tantzen	Graver Tank & Mfg. Co.
237	Robinson	Mallinckrodt Chemical Works
238	LaFave	Chicago Bridge & Iron Co.
239	Ladd	Getty Oil Co.
240	Gray, J. Earle	Getty Oil Co.
241	Fleischhauer	Gietz-Melahn Asphalt Co.
242	Montgomery	U.S. Congress (Miss.)
243	Smith, Robert L.	Warren Bros. Co. (addendum to 128)
244	Esola	Union Paving Co.
245	Ruth	East Kentucky Paving Co.
246	Cady	Allied Chemical Corp.
247	Hovey	N.Y. Division of Air Resources
248	Hamo	Golden Eagle Construction Co.
249	Bumford	N.H. Air Pollution Control Comm.
250	Cramer	Standard Oil of Calif.
251	Tenney	Buell Envirotech
252	Jones, Robert	Donohue & Assoc., Inc.
253	Reynolds	Atlantic Richfield Co.
254	Storlazzi	EPA, Region I
255	Smith	Entropy Environmentalists, Inc.

APPENDIX E. SUMMARY OF COMMENTS AND RESPONSES PERTINENT TO NEW SOURCE PERFORMANCE STANDARDS (40 CFR 60) PROPOSED IN FEDERAL REGISTER OF JUNE 11, 1973 (38 FR 15406)

Comment no.	Commentator no.	Comment	Response
Subpart I. Asphalt Concrete Plants			
I-1	7, 13, 21, 31, 41, 44, 47, 54, 57, 67, 69, 73, 74, 80, 82, 84, 86, 87, 96, 109, 117, 127, 147, 153, 156, 172, 186, 211, 245	The asphalt industry is not a "significant contributor" to air pollution in the United States that endangers or may tend to endanger public health or welfare.	<p>The Clean Air Act, as amended, directs the Administrator to promulgate new source performance standards for sources which he determines may contribute significantly to air pollution, but it does not provide him with specific criteria or guidelines to determine what is significant. Therefore, to make such a determination, the Administrator must rely upon judgement. In the case of particulate matter - a pollutant for which national ambient air quality standards have been promulgated - the Administrator considers all sources to contribute to the endangerment of public health or welfare.</p> <p>The presence of particulate matter in the air is the result of numerous diverse mobile and/or stationary sources. Because ambient concentrations of particulate matter depend upon a number of factors such as distribution of sources, topography, height of which the pollutant is emitted, and meteorological conditions, a source may be considered significant in one location and not in another. This makes it meaningless to develop a firm definition of "significant source" that could be applied nationwide.</p> <p>The Act provides the Administrator of EPA a variety of regulatory authorities which may be used singly or in combination to achieve the purposes of the Act. For particulate matter, the Administrator has determined that comprehensive air quality management strategy is needed to protect public health and welfare and to enhance the quality of our air resources. This air quality management strategy is based on the adoption and enforcement of State implementation plans approved by the Administrator and on new source performance standards promulgated by the Administrator. State implementation plans are designed to achieve and maintain national ambient air quality standards as required under section 110 of the Act, and new source performance standards are designed to facilitate the maintenance of national ambient air quality standards and enhance the nation's air resources as required under section 111 of the Act. Ideally, the Administrator should issue new source performance standards for all sources of particulate matter at one time. This would provide the maximum degree of enhancement of the nation's air resources. Clearly, EPA has neither the resources nor information to establish standards of performance for all sources of particulate matter at one time; therefore, a selection process is used which helps establish priorities for standard setting. In this selection process EPA examines uncontrolled emission rates, proximity to urban areas, stringency of State/local regulations, number of plants, and growth rates. A comparative analysis of some 80 sources of particulate matter showed asphalt concrete plants to be ranked within the first 20 source categories.</p>
I-2	110	A joint industry-government task force should be established for a state of the art study of control technology for asphalt batch plants. EPA can't objectively assess the situation.	Such a task force is not necessary because the industry already has had considerable opportunity to present its views on, and information pertinent to, the proposed standard. Prior to proposal of the standard, EPA and the National Asphalt Pavement Association had over 14 meetings to review progress of the study. The standard was reviewed and approved by the National Air Pollution Control Techniques Advisory Committee (NAPCTAC). Review by NAPCTAC provides for input of opinions from industry, citizens groups, state and local air pollution control agencies, and members of the academic community during the standard setting process. This review provides for an unbiased assessment of the state of the art of control technology.
I-3	82, 86, 153, 156, 186	There should be a public hearing for the asphalt industry.	Section 111 of the Act provides for informal rule making wherein all interested parties have full opportunity to comment upon the proposed standard and its technical basis. The Agency reviews the comments received and explains in final rulemaking its reasons for relying upon or rejecting them. It is EPA's view that the Act does not require more. Prior to proposal of the standard, EPA and the National Asphalt Pavement Association had over 14 meetings to review progress of the study. Throughout the entire study, NAPA was kept

APPENDIX E (continued). SUMMARY OF COMMENTS AND RESPONSES PERTINENT TO NEW SOURCE PERFORMANCE STANDARDS (40 CFR 60) PROPOSED IN FEDERAL REGISTER OF JUNE 11, 1973 (38 FR 15406)

Comment no.	Commentator no.	Comment	Response
			informed of the progress. At the request of the asphalt industry, the House Subcommittee on Environmental Problems Affecting Small Business conducted a hearing on October 1, 1973.
I-4	156, 169	The asphalt industry was not provided an opportunity to participate in the standard setting process.	EPA met with asphalt industry representatives over 14 times prior to proposing the standard. By submitting comments on the proposed standard to EPA during the comment period, the asphalt industry is again participating in the standard setting process.
I-5	29, 32, 190	Environmental impact of the proposed standard was not fully considered.	The effects on air, land, and water of the proposed standard were considered and are discussed in Volume 1 of this document.
I-6	156	EPA did not file an environmental impact statement as required by the National Environmental Policy Act (NEPA).	EPA is not required by NEPA to file an environmental impact statement. See the court's opinion in <u>Portland Cement Association v. William D. Ruckelshaus</u> .
I-7	21	Request a study on health effects and nuisance value associated with asphalt particulate emissions.	Such a study specifically for asphalt particulate emissions is not appropriate or necessary at this time. A health and welfare study for particulate matter was published by EPA in January 1969. Particulate matter was one of the pollutants for which a national ambient air quality standard was promulgated. Details are contained in <u>Air Quality Criteria for Particulate Matter (AP-49)</u> .
I-8	55, 74, 78, 80, 85, 90, 96, 128, 162, 177, 243	Particulate emissions from asphalt plants are not harmful and are similar to those from an unpaved road.	All particulate matter, regardless of whether it is from an unpaved road or an asphalt plant, is considered by EPA to have an adverse effect on health and welfare as evidenced by the fact that a national ambient air quality standard was promulgated for it.
I-9	145	Percent reduction in emissions is higher for asphalt plants than for other industries covered by a proposed standard.	The standards reflect performance that the best system of emission reduction will attain for a particulate industry. Industry characteristics and control system performance vary from industry to industry. In the case of asphalt plants, the particulate emissions are such that high collector efficiencies are attainable. EPA is not required to present affirmative justification for different standards in different industries. See the court's opinion in <u>Portland Cement Association v. William D. Ruckelshaus</u> .
I-10	44, 52, 93, 106, 109, 118, 153, 201	The standard is more restrictive than required to maintain ambient air quality standards.	The objective of standards promulgated under section 111 of the Act is to prevent new air pollution problems from developing by requiring affected sources to use the best systems of emission reduction available at a cost and at a time that is reasonable. These standards are not intended to be related to ambient air quality. Attainment and maintenance of national ambient air quality standards is covered by State implementation plans as provided for under section 110 of the Act. It is not practical or meaningful to make general determinations of changes in ambient air quality that might be caused by new or modified sources. EPA does not know where such sources will be built, and many specific factors, such as topography, meteorological conditions, proximity of other pollution sources, and quantities emitted from all sources, will have great impact on air quality in specific locations.
I-11	51	State and local agencies will adopt the standard for both new and existing sources.	EPA has no legal authority over what State and local agencies do in this regard. As set forth under section 116 of the Act and 40 CFR 60.10, the promulgation of new source performance standards does not prevent State or local jurisdictions from adopting more stringent emission limitations for these same sources. In heavily polluted areas, more restrictive standards may be necessary in order to achieve national ambient air quality standards. The preamble to the proposed standards (38 FR 15406) clearly states that the costs of meeting the standards are considered reasonable for new and modified sources, it is not implied that the same costs apply to retrofitting existing sources.
I-12	93	EPA should study the efficacy of	EPA did study the efficacy of State regulations. See

APPENDIX E (continued). SUMMARY OF COMMENTS AND RESPONSES PERTINENT TO NEW SOURCE PERFORMANCE STANDARDS (40 CFR 60) PROPOSED IN FEDERAL REGISTER OF JUNE 11, 1973 (38 FR 15406)

Comment no.	Commentator no.	Comment	Response
		existing State regulations applicable to asphalt plants.	Volume 1 of the background document.
I-13	80, 90, 96, 111	EPA should publish the names of the manufacturers who claim their equipment will meet the proposed standard and should publish the warranties on the equipment.	The letters containing baghouse warranties are on file in the Emission Standards and Engineering Division of EPA, Durham, N. C. and are available for inspection.
I-14	7, 14, 16, 20, 23, 26, 27, 28, 32, 38, 48, 61, 64, 65, 71, 106, 110, 111, 132, 134, 153, 171, 186, 211	Manufacturers' guarantees do not protect a plant operator from economic losses due to lost production and to administrative and legal costs - i.e., manufacturers will not give unconditional guarantees.	The guarantees will not provide full damages when equipment fails to meet the standard, but they do reflect a degree of confidence in the equipment. If the equipment fails to meet the standard, the manufacturer would incur some liability, and if he knowingly made fraudulent representations as to efficiency of the control device he would be liable for all damages incurred as a result of his representations. Manufacturers would presumably not take such risks without a reasonable degree of confidence in their product.
I-15	72, 92, 96, 156	The standard should not apply to portable plants because EPA did not test any portable plants.	It is true that EPA did not test any portable plants; however, except for the mobility features, the design parameters of portable and stationary asphalt plants are basically the same. Therefore, there is no justification for not including portable plants under the standard. Portable control systems are available having the same features and performance as do stationary control systems.
I-16	197	From the definition of affected facilities it is unclear if the standard applies to raw aggregate storage piles which are exposed and susceptible to wind carry-off of particulate matter.	The standard does not apply to exposed raw aggregate storage piles. The revision to the proposed applicability section of the standard should help clarify this.
I-17	10, 14, 16, 25, 45, 47, 50, 51, 57, 65, 75, 81, 83, 128, 134, 153, 177, 185, 201, 203, 235	Normal replacement or modernization of facilities would require all 4800 existing asphalt plants to meet the standard.	As "modification" is defined under 40 CFR 60.2(h), normal replacement or modernization of a plant, which does not result in an increase in emissions, is not a modification and would not subject a plant to the standard. Only those changes which increase emissions would bring an existing plant under the standard. The applicability section of the proposed standard was revised to clarify the designation of affected facility.
I-18	201	When a portable plant is relocated, would it be considered "modified" and thus subject to the standard?	No. Relocation of a portable plant, in itself, would not be considered a modification under section 111 of the Act.
I-19	156, 243	Does transfer of ownership place an asphalt plant under the proposed standard?	No. Transfer of ownership, in itself, does not constitute a modification under section 111 of the Act.
I-20	156	EPA surveyed 64 reportedly well-controlled plants and rejected 60 of these. The method of selection of plants for emission testing is subject to question.	Our review of asphalt plants, with industry and State/local control officials, led to field visits of about 64 plants. All plants were not equally controlled. For instance, a plant with a low-pressure scrubber (which has a low collection efficiency for particulates) may have been an outstanding example of control for fugitive emissions and therefore support the visible emission standard. In addition, due to weather or mechanical failure, several plants were not operating when visited. Selection of plants for possible stack testing was narrowed to 12 plants. Those plants eliminated were judged on the non-inclusive basis of available emission data, conversations with plant operators/owners regarding control equipment problems and plant operation, and visible emissions ranging from 20 to 60 percent opacity. Five of the 12 plants were scheduled for test, but only four were tested because the fifth shut down for the winter. The other seven of the original 12 were not tested due to: (1) lack of suitable stacks for testing, (2) plant shutdowns for the winter, or (3) one installation used a fabric filter with an air-to-cloth ratio of 1.76-to-1 rather than the 6-to-1 normally used by the industry and a different fabric than normally used by the asphalt industry.
I-21	10, 19, 38, 59,	EPA failed to take the National	The data were taken into consideration and were reported in

APPENDIX E (continued). SUMMARY OF COMMENTS AND RESPONSES PERTINENT TO NEW SOURCE PERFORMANCE STANDARDS (40 CFR 60) PROPOSED IN FEDERAL REGISTER OF JUNE 11, 1973 (38 FR 15406)

Comment no.	Commentator no.	Comment	Response
	83, 84	Asphalt Pavement Association test data into consideration when setting the standard.	Volumes 1 and 2 of this document. Performance test results from two of the four plants tested were not used because of dust buildup in the clean side of the collectors and because the baghouses were operated with pressure drops outside the recommended range. This information was provided by the baghouse manufacturer's representative who inspected the baghouses before the tests were conducted.
I-22	13, 17, 19, 20, 23, 26, 42, 51, 59, 60, 80, 83, 85, 86, 96, 104, 122, 130, 132, 145, 162, 175, 179, 183, 186, 211, 227	EPA has not shown data from a sufficient number of sources to draw statistically valid conclusions about process variability and emission concentration levels from a well-designed and operated plant and its collection system.	Because the Act requires EPA to determine the "degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determines has been adequately demonstrated," the data base upon which the standards are justified will always necessarily be limited. There is no requirement that EPA test all existing plants and base the standard on this information. Even though EPA was only able to test 4 plants, additional data were submitted to the Agency by industry and State/local air pollution control agencies for consideration. Since these additional data are not the sole justification for the proposed standard, extensive verification, beyond calculations and procedural practices checks, is not required.
I-23	83, 110, 156	EPA did not consider the results of EPA Contract #68-02-0076 in the standard setting process.	The test results from the 45 asphalt plants which were summarized in the contract report to EPA were considered in the development of the proposed standard, but were not used because the purpose of the contract was to obtain data for establishing emission factors for different types of control equipment, as typically installed, operated, and maintained. This information is used to estimate emissions and calculate ambient air quality trends. The fabric filter collectors tested under this contract were not representative of best control technology.
I-24	47, 62, 132, 169	EPA tests used for establishing the standard were not conducted at the plant's design capacity.	Three of the four plants tested by EPA were certified by the operators to be operating at capacity. The fourth was operating at 80 to 90 percent of capacity.
I-25	156	EPA failed to discuss the impact of the standard on mobile plants, continuous-mix plants, and drum-mixing plants.	EPA has discussed these three categories with NAPA on several occasions and with equipment manufacturers, the Federal Highway Administration, and control agencies. Specifically, EPA believes that: <ul style="list-style-type: none"> (1) The design parameters of portable and stationary baghouses are basically the same except for mobility features (2) The design parameters for collectors on continuous-mix plants are basically the same as for collectors on batch plants. (3) The drum-mix process is still in the developmental stages. In this process, most of the particulate is trapped by the asphalt in the dryer drum and uncontrolled particulate emissions are less than in a conventional plant. It may be possible to use a fabric filter collector, however, hydrocarbon compounds could condense on the fabric and cause maintenance problems.
I-26	59, 168	Startups and shutdowns increase emissions.	EPA recognizes that these operations may increase emissions, and separate regulations governing emission control during startups and shutdowns were issued in the <u>Federal Register</u> on October 15, 1973 (38 FR 28564).
I-27	113	The proposed standard (0.031 gr/dscf) can be met by asphalt plants in the Los Angeles County Air Pollution Control District.	No response necessary.
I-28	166	Our facilities will meet the proposed standard.	No response necessary.
I-29	99, 200	Agree with the proposed standard.	No response necessary.
I-30	12, 13, 14, 17, 18, 19, 21, 23, 26, 27, 29, 30, 36, 37, 38, 41, 42, 44, 45, 46,	The proposed standard of 0.031 gr/dscf cannot be attained either consistently or at all with currently available equipment.	After considering this comment and others and additional data submitted to the Agency after proposal, the proposed standard of 0.031 gr/dscf was changed to 0.04 gr/dscf for final promulgation. Chapter 3 of this volume includes a complete explanation of why the proposed standard was changed.

APPENDIX E (continued). SUMMARY OF COMMENTS AND RESPONSES PERTINENT TO NEW SOURCE PERFORMANCE STANDARDS (40 CFR 60) PROPOSED IN FEDERAL REGISTER OF JUNE 11, 1973 (38 FR 15406)

Comment no.	Commentator no.	Comment	Response
	47, 51, 52, 53, 54, 57, 58, 59, 66, 67, 69, 71, 77, 79, 80, 81, 82, 83, 84, 85, 86, 88, 90, 97, 102, 104, 109, 112, 114, 115, 116, 117, 118, 119, 120, 123, 124, 127, 135, 136, 137, 144, 145, 146, 151, 152, 153, 154, 156, 157, 158, 159, 161, 162, 167, 168, 170, 171, 172, 175, 177, 183, 185, 186, 187, 188, 189, 190, 198, 199, 202, 208, 211, 213, 215, 216, 217, 218, 219, 220, 222, 223, 224, 225, 226, 228, 229, 230, 241, 242, 244, 246, 248		
I-31	42, 68, 82, 85, 97, 101, 102, 126, 128, 135, 137, 156, 198, 207	The standard for particulate matter should be: (1) 0.06 gr/dscf, (2) 0.05 gr/dscf or greater, or (3) between 0.10 and 0.20 gr/dscf.	The proposed standard of 0.031 gr/dscf was changed to 0.04 gr/dscf for final promulgation. See Chapter 3 of this volume for an explanation of why the change was made.
I-32	38, 51, 59, 82, 83	The standard should be based on process weight.	In developing the proposed standard, process weight was considered as a basis but rejected. The reasons why the proposed standard was based on concentration are given on page 2, Volume 1 of this document.
I-33	18, 65, 84, 86, 92	The proposed standard (0.031 gr/dscf) cannot be achieved when fuel oils are used in the dryer. Some allowance for particulate generated by burning heavier grade petroleum products should be incorporated in the standard.	The proposed standard of 0.031 gr/dscf was changed to 0.04 gr/dscf for final promulgation. See Chapter 3 of this volume for an explanation of why the change was made.
I-34	24, 67, 168	There are no visible emissions from our baghouse but we don't know if it can meet the proposed 0.031 gr/dscf standard	No response necessary.
I-35	57, 60, 83, 113, 113A, 150, 153, 204, 208	The following comments were received on the proposed opacity standard: (1) The particulate standard and the opacity standard are incompatible. The opacity standard should allow emissions greater than 10 percent opacity for 3 minutes in any 1 hour (2) The opacity standard should allow emissions greater than 10 percent opacity but less than 40 percent opacity for up to 4 minutes in any one hour. (3) Opacity should be used as an indicator of compliance with the mass particulate standard, not as a standard in itself. (4) Opacity readings were reported in Volume 2 of the background document for only 3 of 15 plants tested. This is a rather meager substantiation of the opacity standard. (5) The opacity method (method 9) is unreliable and the opacity data do not provide a basis for setting any regulated level. (6) What is the reason for permitting a 2-minute exemption from the 10% opacity standard?	See the discussion of opacity standards in Chapters 2 and 3 of this volume.

APPENDIX E (continued). SUMMARY OF COMMENTS AND RESPONSES PERTINENT TO NEW SOURCE PERFORMANCE STANDARDS (40 CFR 60) PROPOSED IN FEDERAL REGISTER OF JUNE 11, 1973 (38 FR 15406)

Comment no.	Commentator no.	Comment	Response
I-36	156, 169	EPA misquoted the results of Rylander report on correlation between particle size and capture efficiency of a fabric filter.	EPA did not misquote the Rylander study, as shown by Mr. Rylander's letter of July 17, 1973 to Mr. Fred Kloiber of NAPA in which he states "From our bench model filter tests we could not obtain a correlation between particle size and capture efficacy of a fabric filter."
I-37	156	Particulate emissions from cement plants have smaller fines content than do emissions from asphalt plants, yet both plants use similar control equipment. The new source performance standards permit higher levels of emissions for cement plants than for asphalt plants in apparent recognition of this.	EPA is not required to present justification for different standards for different industries. The essential question is whether or not the standard can be met by the affected industry and this is decided on the basis of information concerning that industry alone. See <i>Portland Cement Association v. William D. Ruckelshaus</i> . Control equipment used for the two industries is similar only in that baghouses are employed. The cement industry commonly uses baghouses with different design, with an air-to-cloth ratio of 2:1, and with a different fabric filter.
I-38	2, 7, 8, 32, 36, 40, 54, 57, 61, 64, 65, 69, 83, 89, 100, 101, 106, 110, 132, 169, 199, 241, 245	No consideration was given to the effect of the aggregate particle shape (e.g., spheres, needles) on the efficiency of the collector. The proposed standard can only be achieved when using dry, coarse aggregate mix	The effects of aggregate variations on baghouse performance have been investigated by EPA and by the asphalt industry. It is recognized that aggregate characteristics that affect particle size, shape, and lubricity vary among geographic locations. Particulate matter which is spherical in shape, has an average fineness below 5 microns, and is slippery and smooth will decrease the performance of a baghouse; however, available information indicates that aggregates used by asphalt plants do not produce particulate matter of this size and shape. EPA tests were conducted at plants having aggregate mixtures with fines (-200 mesh) ranging from 2 to 7 percent by weight. In general, the amount of fines in aggregate is approximately 3 percent. There may be some aggregates of which EPA is not aware that would have a size, shape, and lubricity that would affect control efficiency. The proposed standard of 0.031 gr/dscf was changed to 0.04 gr/dscf for final promulgation. See Chapter 3 of this volume for an explanation of why the change was made.
I-39	59	The moisture content of the incoming aggregate and the dried aggregate should be described in Volume 1 or 2 of the background document because it affects collector efficiency.	This information was omitted because it is not considered relevant to the standard. The moisture content of the incoming aggregate determines the dryer capacity. In general, dryers are designed for aggregates with 5 percent moisture. When the moisture exceeds 5 percent, dryer capacity is decreased. Aggregates will drain to a moisture content of approximately 2 percent; therefore, 8 percent is the maximum moisture content found in the incoming aggregate.
I-40	20, 40, 41, 47, 67, 81, 106	The standard should take into account the effect of ambient humidity on the ability to control particulate emissions.	No relationship exists between ambient humidity and control of emissions, provided the temperature of the gases in the baghouse is kept above the dew point.
I-41	197	Does the emissions records requirement, section 60.93, mean that records of opacity measurements must be kept?	No
I-42	145	Clarify section 60.94(d)(1) so it is understood that only the front half of the EPA train is used in determining compliance, not the entire train.	This is not necessary because method 5, which is referenced as the test method under 60.94(d)(1), does not require measurement of anything except the particulate matter collected in the probe and filter, the particulate matter collected in the wet impingers is not determined. The impingers are optional in the sampling train and can be replaced by an equivalent condenser.
I-43	197	A stack is required in order to use method 5 as required by section 60.94(d). Does this preclude the use of a pressurized baghouse?	No. Pressurized baghouses may be used with a stack so that method 5 can be used. As provided under section 60.8(b), the Administrator may approve an alternative method or waive the performance test requirement if the owner or operator can demonstrate compliance by some other means.
I-44	197	A large proportion of particulate emissions from asphalt plants is collected in method 5 impingers. The full EPA train should be used as the test method because any fraction not collected in the impingers will contribute to measured ambient	The method was changed in response to comments received when the first group of standards was proposed. The rationale for changing the method is still considered to be valid. Until more information is received which indicates the need for use of the full train catch, method 5 will consist of the front half only (probe and filter catches only)

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		Levels of suspended particulate.	
I-45	82	A 0.03 gr/dscf, EPA method 5 is unreliable and its reproducibility is on the order of ± 100 percent.	Preliminary analyses indicate that method 5 is reproducible within a factor of ± 10 percent. This is considered adequate for testing stack emissions. Preliminary data are available in EPA files in Durham, North Carolina.
I-46	208	Precision and accuracy of method 5 have not been established.	It is true that the precision and accuracy of this method have not been definitely established; however, preliminary data based on field tests are available that indicate an inter-laboratory precision (reproducibility) of ± 10 percent. Error analysis of the testing equipment variables indicates that the method has an intralaboratory precision (repeatability) of ± 6 percent. Studies of method accuracy are hampered by the lack of a facility for generating known concentrations of particulate matter. Such a generator is under construction and accuracy studies are expected to be completed in 1974.
I-47	63, 83, 156, 169	In the emission tests, EPA failed to follow method 5 in the following ways: (a) Sample time was less than 5 minutes at each point. (b) Sample time was less than 60 minutes. (c) Three repetitions were not performed in all tests of plants. (d) Dimensions of the stack and numbers of tests points on the traverse were not given in the reports. (e) Samples were not within the range 90 to 100 percent isokinetic. (f) Dilution air was not determined.	All of these points are true, however, the deviations from method 5 are so minor that the test results are still considered valid. It must be pointed out that method 5 plays a dual role (1) it serves as the method for data gathering during the development of a standard of performance and (2) it serves as the method for determining compliance (during a performance test) of new or modified sources covered by a performance standard. Testing during the standard development process is done primarily on sources that were retrofitted with control equipment and that are not necessarily designed to facilitate testing. In addition, EPA data-gathering tests are conducted during the normal production run of a process, thus, testing duration is controlled by the operation schedule of the plant. This is unlike testing which would be performed during a performance test. The objective of method 5 is to set forth a uniform procedure for determining particulate emissions with maximum accuracy and precision under a variety of conditions. There are procedures in the method which, subject to engineering judgment, can be considered flexible in certain cases without sacrificing the reliability of the test results. Method 5 is being revised to clarify this point. Deviations from the specified procedures are however, subject to approval by the Administrator. The data concerning dimensions of stacks and numbers of test points are available in EPA files in Durham, North Carolina. A review of these data indicates that the number of traverse points used conforms to method 1. The failure to include these data in the test reports was an oversight. The results included in the test reports were reviewed and some calculation errors were found. Correction of the errors indicated that all of the samples had been obtained within the range of 90 to 100 percent isokinetic flow conditions. "Dilution air" is considered to be air which is added to a gas stream for the purpose of diluting the concentration of particulate matter in order to comply with an applicable standard. Dilution air was not added during any test. The percent excess air was calculated from the Orsat analysis, and the results are reported in the test reports on those plants tested by EPA.
I-48	11, 19, 82, 225	EPA should conduct a comparative cost-benefit study for an 0.06 gr/dscf standard and the proposed standard (0.031 gr/dscf)	A cost benefit analysis, showing the benefit to ambient air conditions as measured against the cost of the pollution control devices required to meet a standard is not a requirement in considering costs. See <u>Portland Cement Association v. William D. Ruckelshaus</u> .
I-49	19, 32, 46, 85, 144, 153, 241	Asphalt plants cannot afford the control costs required by the proposed standard.	The proposed standard (0.031 gr/dscf) was changed to 0.04 gr/dscf for final promulgation. It is our judgment that the incremental investment required by the final standard will generally not create any serious additional financing problems for new asphalt concrete plants. The February 1972 <u>Economics of Clean Air</u> concluded that asphalt concrete plants meeting State emission standards

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			<p>should be able to increase prices to cover the added cost of pollution control. Because the annual cost for a new plant meeting the final standard closely approximates the cost for an existing plant meeting a typical State standard, our judgment is that a new plant will not be placed at a competitive disadvantage. These judgments have been reinforced by NAPA's public comments that were submitted to EPA on July 24, 1973. On page 49 of their comments they stated:</p> <p>"The National Asphalt Pavement Association, as it has indicated on many occasions to EPA, submits that the legitimate goal of protecting the environment and reducing emissions will be achieved by the imposition of a .06 standard rather than the .031 standard. It is submitted by the industry that this will result in an improvement of the emission levels by 99.8%, and is consistent with the goal which has been stated, of 99.7% by the Environmental Protection Agency. Further, it is submitted that the reduction is achievable at a reasonable cost without unduly endangering the existence of the industry or forcing the use of other alternative products. Thus, it is submitted that it is important that the standard be .06 and not .031."</p> <p>"It is important that it be recognized that if the standard is .06, the equipment which will be required to be purchased will be either a venturi scrubber with a minimum 20-inch pressure drop or a baghouse with a 6 to 1 air-to-cloth ratio. It is submitted that there will be a significant improvement in the environment with an .06 standard. The .06 standard will further require that the plants be kept in good operating repair and condition or they will fail to meet the .06 standard. A .06 standard will avoid the problems of the size and shape of the particulates and also other problems which cannot be answered at the present time."</p> <p>NAPA's conclusion is that the cost for a venturi scrubber with a 20-inch pressure drop or a baghouse with a 6:1 air-to-cloth ratio is reasonable. It is EPA's contention that this equipment will achieve the final standard (0.04 gr/dscf). Thus, NAPA's conclusion that cost for this type of equipment is reasonable reinforces our judgment that the cost to meet the final standard is reasonable.</p>
I-50	7, 12, 14, 16, 18, 23, 25, 26, 27, 28, 29, 30, 33, 50, 54, 57, 65, 67, 69, 72, 75, 81, 89, 107, 112, 121, 128, 140, 145, 147, 153, 163, 185, 198, 230, 235	The small operator cannot afford to install control equipment and will be forced out of business.	The costs of the standard to an owner or operator are considered reasonable for all sizes of plants; there is no economic penalty to small plants. The standard does not apply to existing plants. If a small operator decides to modify an existing plant or build a new plant, will add about 6 to 10 percent to the cost of a plant designed to comply with State regulations. See response to comment I-49 regarding reasonableness of the costs.
I-51	39, 41, 84, 102	EPA stated that 30 to 40 percent of small operators would be forced out of business.	This estimate, from the February 1972 <u>Economics of Clean Air</u> , applies to costs for complying with State Implementation Plans, not with the proposed new source performance standard.
I-52	10, 21, 41, 57, 65, 74, 84, 89, 100, 101, 120, 145, 156, 170, 220	The standard will stifle growth of the asphalt industry and development of new and better equipment.	As indicated in the preceding comments, costs are reasonable. It is therefore difficult to see why normal growth and development should not occur.
I-53	25, 31, 33, 65, 74, 88, 89, 92, 96, 101, 149, 172, 199	The proposed standard will increase highway construction costs.	The standard will increase the cost of asphalt concrete about \$0.02/ton over the cost of meeting normal State regulations, which is \$0.20/ton more than costs for asphalt concrete produced in uncontrolled plants. Two cents per ton amounts to 1/4 of 1 percent of the price of an \$8.00 ton of asphalt. Since asphalt concrete represents only 20 to 40 percent of highway construction costs, the effect on highway construction should be miniscule.
I-54	145	Costs for control of particulate emissions are greater for	The Act does not require that control costs be the same for all industries affected by new source performance standards.

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		asphalt plants than for the other Group II industries.	
I-55	156	EPA has miscalculated the economic cost of the proposed standard since the number of plants becoming subject to the standard will increase substantially, even assuming no new plants will be needed to meet increased demand. NAPA claims that 480 plants will require replacement each year.	EPA's cost analysis is based on a "model plant;" costs are calculated for this design and size plant. The total number of plants subject to the standard is not pertinent if cost per plant does not increase substantially. If indeed 480 plants will be subject each year to the standard, then this is all the more reason for need of a standard.
I-56	156	EPA has erroneously estimated that the annual growth rate for the asphalt concrete industry is 10 percent.	The 10 percent growth figure was based on production figures for 4 years. During the last 10 years the rate was only 6.6 percent. The rate for the last 3 years was 2.2 percent. EPA has revised the growth rate figure to 5 percent on the assumptions that: (1) the 2.2 percent figure is abnormally low and (2) a slowdown of interstate highway construction will probably make the 6.6 percent figure too high.
I-57	25, 84, 87, 109, 146, 170, 203	EPA has ignored the projected power requirement involved.	The power requirement was considered in the economic analysis of the standard.
I-58	17, 26, 83, 84, 220, 245	No control cost estimates are provided for retrofitted, modified plants.	Cost estimates for retrofitting were not considered necessary because the cost to control a modified plant would not be higher than to control a new plant. Sources are considered "modified" under the Act only when modification results in increased emissions. Costs will ordinarily be lower for retrofitting modified plants than for installing control equipment in new plants because modified plants often have much of the necessary ductwork, electrical switchgear, etc.
I-59	145	Control costs will increase the cost of new or modified equipment by 24 percent.	Most of the increase is due to State and local air pollution regulations that require low-energy scrubbers. Only 7 to 10 percent of this increase will result from meeting the standard of 0.04 gr/dscf.
I-60	106, 156	Estimated control costs per ton of asphalt are incorrect because costs are based on an on-stream time of 50 percent and on a 100 percent capacity production. NAPA claims that 1972 annual production was 25 percent of the total installed capacity.	NAPA gathered data from its 657 member firms, each of which has an average of 2.75 plants. These plants each average 180 tons/hr capacity and operate about 1500 hrs/yr. Therefore full capacity would amount to: (657 firms)(2.75 plants/firm)(180 tons/hr)(1500 hrs/yr) = 487,800,000 tons/year. The 1972 production by NAPA members was 240,500,000 tons, which is 49 percent of capacity. Since EPA used 50 percent of capacity, the costs are deemed correct.
I-61	10, 13, 17, 24, 28, 33, 39, 53, 55, 61, 73, 78, 84, 106, 122, 126, 132, 134, 177, 183, 220, 245	EPA control cost estimates are too low. A more typical figure to bring an installation into compliance is \$80,000 to \$600,000 - an added cost to the product of \$0.36/ton.	EPA has reviewed and revised the cost estimates and they compare favorably with the range of the eight estimates provided by NAPA. The revised economic analysis is included as Appendix B of this document.
I-62	61	Control cost estimates do not include lost income due to lost production during installation and adjustment of a control unit.	There should be no lost production time due to installation and adjustment. In a new plant, or in a plant being extensively modified, the control device construction should be completed simultaneously with, or before, the rest of the plant. Since NAPA tells us that plants operate only 8 to 10 hours a day, there is ample time for adjustments and "fine tuning" of the control device. Therefore, no costs were assigned to lost production time.
I-63	11	Cost estimates for a low-pressure venturi scrubber are too high. Costs will more likely be around \$10,000.	The Percy Todd Manufacturing Company enclosed copies of invoices to show that their basic unit costs \$8025. This cost, adjusted for 1971 dollars, compares closely with the \$8800 cost for an IGC1 unit for the same size plant. The larger EPA figure includes the cost of interconnecting ductwork, primary collector, wet scrubber, fan, slurry pumps, settler and clarified water return pumps, and sludge tank. This brings the total to about \$22,000. Another \$26,000 is required for installation. When all factors are taken into account, the investment costs for a Todd unit would be very close to those for EPA units.
I-64	156	To consistently achieve the proposed standard (0.031 gr/dscf), a baghouse must have	The proposed standard was changed to 0.04 gr/dscf for final promulgation. The reasons for the change are given in Chapter 3 of this volume of the background document. A

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		an air-to-cloth ratio lower than 6:1. Costs to achieve the 0.031 gr/dscf standard using a 4:1 rather than a 6:1 air-to-cloth ratio increase by 40 percent.	baghouse with a 6:1 air-to-cloth ratio should meet the 0.04 gr/dscf standard if it is properly designed, installed, operated, and maintained.
I-65	156	EPA's cost estimate of \$9.00/ton for mineral filler is incorrect; it should be around \$3.39/ton.	The \$9.00 value was based on information from trip reports. Valid information from the National Crushed Stone Association supports the \$3.39/ton figure. EPA calculations have been adjusted to reflect the lower value.
I-66	61	Some States won't allow the use of collected fines in asphalt concrete.	Although this may be true for certain types of asphalt concrete, it is not considered a significant problem. This situation is considered in the economic analysis; however, it does not increase costs to the extent that they become unreasonable. For a fabric filter without recycle equipment, investment costs would be 10 to 15 percent lower, but operating costs would be \$0.02 to \$0.03 per ton higher.
I-67	57	Manpower costs caused by the monitoring and record-keeping requirements were not considered.	No monitoring equipment is required and record keeping is limited to filing the original test data. Therefore, there are no manpower costs.
I-68	30, 57, 90, 96, 111, 162	Do not want to buy the expensive equipment required for monitoring and testing.	Because there are no continuous monitoring equipment requirements and because performance tests may be conducted by a consulting firm or control equipment vendor, there need be no testing equipment costs.

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<u>Subpart J. Petroleum Refineries</u>			
J-1	197	Fluid coking units should be listed as an affected facility.	No data concerning emissions from such units have yet been collected by EPA nor have the systems for emission control yet been studied.
J-2	105, 125, 131, 163, 164, 173, 181, 182, 184, 205, 209, 210, 239, 240	The definition of "petroleum refinery" used in the regulation could be interpreted as including crude oil production facilities, gas plants, and natural gasoline plants. The definition should be revised to apply only to petroleum refineries.	Agree. The definition has been made more specific to prevent misinterpretation.
J-3	131, 163, 197	The definition of "petroleum" used in the regulation excludes the petroleum extracted from shale, tar sands, and coal. Shouldn't such petroleum be included?	Yes. The definition has been changed to clearly include petroleum extracted from shale, tar sands, and coal.
J-4	125, 131, 141, 163, 181, 205	The definition of "hydrocarbon" is too broad and ambiguous.	This definition is no longer required and has been deleted from the promulgated regulations.
J-5	128, 141	The definition of "process gas" should have included the non-hydrocarbon gases produced by various process units in a refinery.	The definition has been revised to include all gases produced by process units in a refinery except fuel gas and process upset gas.
J-6	105, 143, 184, 239	"Fuel gas" should be defined only as gas burned in heaters and boilers to avoid having H ₂ S standard apply to stack gases from fluid catalytic cracking catalyst regenerators (FCCCR) and fluid coking unit coke burners (FCUCB).	Agree. The definition of "fuel gas" has been changed to include only those gases generated by a refinery process unit and combusted as a fuel. Both the FCCCR stack gases and the FCUCB stack gases are exempt from the H ₂ S standard.
J-7	105, 143, 163, 176, 182, 184, 239	The definition of "waste gas disposal system" should clearly indicate that emergency flare systems are not included so that the H ₂ S standard does not apply to the emergency flare systems.	The H ₂ S standard applies to flare systems as well as process heaters and boilers. However, the standard is not applicable to flare systems when the flare is used as a safety device under emergency conditions. The standard has been revised to clarify this distinction.
J-8	184	In the economic analysis, the credit for the useful energy derived from a CO boiler should not be used to reduce the debit for the installation and use of an electrostatic precipitator (ESP).	A CO boiler credit was not used to offset ESP costs. See pp. 22-23 of Volume 1 of this document for separate analyses of the costs. On the basis of these separate analyses, the costs for compliance were judged to be reasonable.
J-9	49, 174, 184, 221	The costs of amine treaters and Claus plant tail-gas scrubbers should be included in the economic analysis for H ₂ S control. Small refineries cannot afford such equipment and should be exempt from the H ₂ S standards.	EPA agrees that amine treater costs should be included, particularly as related to small refineries which might not otherwise install such equipment. This cost analysis has now been completed and small-unit costs are considered reasonable. See Chapter 4 and Appendix C of this volume for details of the analysis. The costs of Claus plant tail-gas scrubbing are not included in the economic analysis because such scrubbing is not needed to comply with the standard.
J-10	105, 163, 174, 191, 195	The cost to control a small fluid catalytic cracking unit (FCCU) would be prohibitive. Some provision should be made to exempt small FCCUs, or the standard should be relaxed.	EPA has analyzed small-unit costs and found them to be reasonable. See Chapter 4 and Appendix C of this document for details of the analysis.
J-11	113, 131, 141, 163, 182	The facilities to which the standards apply should be specifically identified in the regulation.	The regulation has been revised to identify clearly the specific affected facilities.

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J-12	197	The particulate emission standard appears to be unduly restrictive when compared with the Group 1 standard for power plants	EPA is not required to present justification for different standards for different industries. The essential question is whether or not the standard can be met by the affected industry and this is decided on the basis of information concerning that industry alone. See <u>Portland Cement Association v. William D. Ruckelshaus</u> .
J-13	191, 197	Regulations on burning of sulfur-containing fuel in refineries should not be more restrictive than regulations on burning of sulfur-containing fuel in other facilities such as Group 1 utility boilers	See response to J-12.
J-14	166	Boilers of less than 250 million Btu/hour heat input should be exempt from the standard to be consistent with the Group 1 standard for power plants and to reduce recordkeeping	See response to J-12. Many refinery boilers smaller than 250 million Btu/hour heat input should and can comply with the standards.
J-15	111	The regulation does not specify a standard basis to which concentration of SO ₂ should be calculated if compliance testing of the combustion gases is performed. Circumvention of the standard is thus possible by use of excess air	A paragraph added to the General Provisions (subpart A, 40 CFR 60) prohibits the use of dilution air and other circumvention techniques to achieve compliance with any new source performance standard. The petroleum refinery standard has been changed to require that an owner or operator who elects to control SO ₂ emissions by methods other than removal of H ₂ S before the gas is burned must demonstrate to the satisfaction of the Administrator that equivalent control is achieved.
J-16	105, 163, 239	Although it may be feasible to attain particulate emission concentrations of 0.022 gr/dscf when the control equipment is new, it is very difficult to attain this continually over life of equipment. The standard should be revised to 0.04 gr/dscf	Long-term data gathered by EPA on particulate emissions from precipitators operating on fluid catalytic cracking units in the petroleum industry and in other applications in other industries indicate that, with good maintenance, precipitators will continue to operate at a high efficiency, meeting or exceeding design conditions and specifications for the life of the equipment. Detailed discussions with the major vendors serving the petroleum refinery industry confirm this. See Chapter 4 of this volume for an additional discussion of this point. See response to J-16.
J-17	184	Continual compliance with the proposed particulate regulation is not possible, the regulation should be revised to require average emission concentrations of 0.022 gr/dscf but permit maximum emission concentrations of 0.044 gr/dscf	See response to J-16.
J-18	184	The 3-minute/hour exemption period allowed in the opacity standard for soot blowing is too short. Industry experience shows 5 minutes is more reasonable	See the discussion of opacity standards in Chapters 2 and 4 of this document (Volume 3).
J-19	197	With particulate emission concentrations of 0.022 gr/dscf, the plume should not be visible. Opacity standard should be no visible emissions rather than 20 percent	See the discussion of opacity standards in Chapters 2 and 4 of this document (Volume 3).
J-20	105, 163, 181, 184, 239	Vendors refuse to guarantee opacity of emissions. Industry data show that to consistently meet a 20 percent opacity regulation, grain loadings must be less than 0.01 gr/dscf, much less than 0.022 gr/dscf. Thus opacity should be used as a guide to determine when a source test is necessary to check compliance.	See the discussion of opacity standards in Chapters 2 and 4 of this document (Volume 3).
J-21	205, 251, 253	Where the precipitator precedes the carbon monoxide boiler, the proposed particulate matter regulation permits dilution by the carbon monoxide boiler flue gases. Where the precipitator follows the carbon monoxide boiler, such dilution is not possible. Thus, the regulation is lenient if the boiler follows the precipitator	Agree. Under the proposed regulations two identical fluid catalytic cracking unit catalyst regenerators could discharge different volumes of gases to the atmosphere, depending on the placement of the CO boiler with respect to the electrostatic precipitator. The promulgated regulations are based on coke burn-off rate in the catalyst regenerator; thus particulate emissions do not depend on the volume of gases discharged to the atmosphere, so placement of the CO boiler with respect to the electrostatic precipitator has no effect on particulate emissions

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J-22	197	Why are allowances given for incremental increases in particulate emissions if liquid or solid fuel is burned in the carbon monoxide boiler?	All the fluid catalytic cracking catalyst regenerators tested and studied by EPA were burning natural gas in the CO boiler. However, during certain months of the year natural gas is not available and liquid fuels must be used instead. Since the combustion of liquid (or solid) fuels will increase particulate emissions, an allowance for liquid or solid fuel is included in the regulation, based on the Group I utility boiler standards.
J-23	105	Just as an allowance is made for incremental increases in particulate emissions if liquid or solid fuel is burned in carbon monoxide boilers, the standard should include an allowance for the burning of gaseous fuel.	Units tested by EPA were burning gaseous auxiliary fuel, so the standard takes this into account.
J-24	105, 176, 182, 184	Regulations should be revised to state specifically what monitoring requirements are necessary on what affected facilities.	Agree. The regulations have been so revised.
J-25	131	Monitoring requirements should apply only if emissions are above some specified level.	Monitoring instruments are necessary to ensure proper operation and maintenance of emission control systems.
J-26	131	Monitoring of firebox temperature is not necessary.	Monitoring of both firebox temperature and oxygen content of gases is necessary to ensure oxidation of CO to CO ₂ .
J-27	176, 182	Requiring the maintenance of separate records and files for pollution control information is unreasonable. The use of operating unit log sheets would be adequate.	Operating unit log sheets record spot values at wide intervals. These data are not adequate to ensure proper operation and maintenance of the emission control system.
J-28	113, 163, 166, 176, 184	The regulations need to be revised to specifically state whether H ₂ S is to be monitored at each heater, boiler, and flare system or for the fuel gas system as a whole.	The regulations have been revised to permit the monitoring of H ₂ S in the fuel gas system as a whole.
J-29	113	The regulations should require monitoring of H ₂ S at points before refinery fuel gas streams are blended to prohibit meeting the regulation by blending.	The standard is based on blended fuel gas streams since this is a common refinery practice. However, blended fuel gas streams commonly contain H ₂ S in considerably greater concentrations than 230 mg/dscm, and the purchase of large volumes of natural gas for blending with refinery fuel gas merely to reduce the H ₂ S concentration of all fuel gases to below 230 mg/dscm is not likely to be a practical alternative to treating the fuel gas to remove H ₂ S.
J-30	167	There is no need to monitor the fuel gas system continuously. The control room instrumentation will indicate if amine scrubbing units are operating normally.	The parameters monitored in control rooms to determine proper operation do not reflect the hydrogen sulfide concentration nor do they indicate how well it is controlled.
J-31	197, 163, 204	Release of gases to the atmosphere should not be permitted if such gases contain hydrogen sulfide (H ₂ S) in concentrations greater than 230 mg per dry cubic meter at standard conditions. Incineration of such gases should be required. Unburned H ₂ S should be monitored in stack gases.	The standard applies to emissions for sulfur dioxide (SO ₂), not H ₂ S, and restricting the release of H ₂ S to the atmosphere does not control SO ₂ emissions. Because H ₂ S released to the atmosphere would cause a stench, common practice in most refineries is to flare gases containing H ₂ S. However, SO ₂ is formed when H ₂ S is burned, so the most effective way to control SO ₂ emissions is to remove substantial amounts of H ₂ S from gases before they are burned, as the regulation requires.
J-32	143, 163, 166, 174	There is no need to keep a daily record of the production rate for the fluid catalytic cracking unit.	Agree. This requirement has been removed from the regulation.

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Comment no.	Commentator no.	Comment	Response
<u>Subpart K. Storage Vessels for Petroleum Liquids</u>			
K-1	95, 105, 131, 143, 164, 165, 166, 176, 181, 182, 184, 195, 210, 239, 240	Exempt storage of crude oil and condensate at producing facilities in the field from the standard. Reasons given included: (1) the large cost differential in switching from the bolted-construction, fixed-roof tanks in common use to the welded, floating-roof tanks needed for compliance with the standard; (2) the very small emissions of those hydrocarbons which contribute to the formation of photochemical oxidants; (3) the relatively small size of these tanks and their commonly remote locations; and (4) the understanding that EPA did not intend to make the standard apply to such tanks.	It was EPA's intent to exempt such storage vessels. The regulation has been amended to clarify this. The exemption applies to storage between the time that the oil and condensate are removed from the ground and the time that custody of these products is transferred from the well or producing operations to the transportation operations.
K-2	108	Increase tank size exemption to 320,000 liters (84,500 gallons) as this is the most common size used in storage of diesel fuel and pipeline interfaces, which are normally of low volatility	Diesel fuels are exempt from the standard. Interfaces of low volatility, i.e., less than 1.5 psia true vapor pressure, are exempt.
K-3	240	Increase size of all storage tank exemptions to 50,000 barrels (2,000,000 gallons) as this is the most economical size	EPA's economic data do not support this contention. The data indicate that the exemption threshold is reasonable.
K-4	34, 95, 105, 108, 131, 164, 166, 167, 181, 184, 209, 238, 240	The definition of "storage vessel" is too broad. It includes subsurface caverns, porous rock reservoirs, and high-pressure tanks capable of operating at pressures sufficiently high to prevent emissions to the atmosphere. These types of storage are optimum for preventing the release of emissions to the atmosphere and require no additional control devices	Agree. The regulation has been amended to exclude such storage.
K-5	35, 91, 95, 131, 232	The definition of "petroleum liquid" is too broad. It can be considered as encompassing any products made from petroleum, including petrochemicals, and these products were not studied by EPA.	The definition has been amended to clarify applicability.
K-6	105, 184, 236	The definition of "floating roof" does not include covered floating roofs and internal floating covers, which are surely acceptable as control devices	Agree. These devices are acceptable. The definition has been amended to include such devices.
K-7	35, 125, 143, 184	The definition of "vapor recovery system" can be interpreted to demand complete, 100 percent recovery — an impractical demand.	This was not EPA's intent. The use of the word "prevent" is not meant to imply total stoppage, and this is made clear in the preamble to the promulgated regulations.
K-8	15, 105, 125, 139, 142, 143, 163, 231, 239	The standard should not require conservation vents on storage vessels when the true vapor pressure of the petroleum liquid stored is 78 mm Hg or less because (1) such vents become fouled when some heavy liquids are stored and when ice forms on the vents during cold weather, and (2) the beneficial effect on emissions is minimal.	Agree. Regulation is amended to exclude the requirement for conservation vents.
K-9	3, 9, 22, 70	The proposed standard duplicates state rules and regulations and is not needed. It should be dropped where existing state plans are in effect.	The intent of new source performance standards under section 111 of the Clean Air Act is to require nationwide the best adequately demonstrated, economically reasonable system of emission controls. There is no provision for exempting facilities located in states where good state regulations require similar control of emissions.

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Comment no.	Commentator no.	Comment	Response
K-10	3, 9, 22, 35, 70, 95, 105, 108, 142, 143, 150, 163, 166, 176, 181, 182, 184, 197, 210, 231, 237, 239, 240	The monitoring requirements impose a heavy expenditure of manpower and money to collect, record, and retain information that is not really needed. For example: (1) recording daily tank temperatures for the thousands of tanks in remote tank farms, terminals, and marketing operations is impractical and not needed, (2) most products are manufactured to specifications and have typical vapor pressures over reasonably narrow ranges. These can be used instead of the required daily sampling and analysis to determine true vapor pressures, and (3) surely there is no intent to demand constant compliance and surveillance.	The regulation has been amended to reduce the monitoring requirements. The requirements were based on the information-gathering facilities which were known to exist at modern refineries, and the comments and EPA's subsequent follow-up clearly showed that the operators of remote tank farms, terminals, and marketing operations would have been unjustifiably burdened.
K-11	105, 113, 176, 184, 197, 238, 239	The storage vessel maintenance requirements are not workable because: (1) the colors and types of paints to be used on tanks are not specified, (2) some localities require paints that blend with the location, (3) the desired condition of the seal is not specified, and (4) it is not reasonable to require that sampling ports on floating-roof tanks be gas-tight.	The maintenance requirements have been removed from the regulation. The intent was to ensure that good maintenance practices were employed, and the requirements were not sufficiently explicit for this purpose. A recently published change to subpart A (40 CFR 60), General Provisions, requires that all facilities subject to new source performance standards must be, to the extent practicable, operated and maintained in a manner consistent with good air pollution control practice for minimizing emissions. This will achieve the purpose for which the proposed storage vessel maintenance requirements were intended.
<u>Subpart L Secondary Lead Smelters</u>			
L-1	204	The term "reverberatory furnace" should not be used to define a reverberatory furnace.	The intent was to show the types of reverberatory furnaces that were covered by this regulation. The definition has been revised to clarify this intent.
L-2	204	"Pot furnace" and "cupola" should be defined.	The terms were intended to convey the same meanings as those generally accepted in the industry, and no definitions were considered necessary.
L-3	62, 113, 196, 204	The opacity standards should be changed for the following reasons: (1) there is no basis for the 2-minute/hour exemption, (2) an upper limit should be established for the exemption period, and (3) the opacity standard cannot be met by smelters that meet the concentration standard.	See the discussion of opacity standards in Chapters 2 and 6 of this document (Volume 3).
L-4	196	Why is the particulate standard for secondary lead blast and reverberatory furnaces 0.02 gr/dscf when the data support a limit of 0.01 gr/dscf?	Test data serve as a guideline for setting standards, but other factors must be considered as well, the application of engineering judgment is an important part of standard development. In this particular case, the following facts influenced the choice of the number for the standard: (1) designers and manufacturers of control equipment will guarantee concentrations between 0.015 and 0.020 gr/dscf, and (2) EPA did not want to exclude the use of scrubbers as an applicable control device. The test data indicate that a high-pressure-drop scrubber cannot consistently reduce particulate emissions to 0.01 gr/dscf but that it should be able to achieve 0.02 gr/dscf.
L-5	62	EPA should have proposed standards to control SO ₂ emissions because these emissions may result in violation of ambient air quality standards.	Ambient air quality is protected under section 110 of the Clean Air Act. New source performance standards are promulgated under section 111 of the Act to prevent future problems from developing by requiring the use of the best system of adequately demonstrated control that is economically feasible. Time and money dictate that some pollutants must be dealt with before others. During EPA's study of secondary lead smelters and refineries, it appeared sensible to defer standards for control of SO ₂ emissions until standards for more significant emissions had been set.

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Comment no.	Commentator no.	Comment	Response
L-6	113	The size below which pot furnaces are exempt from the standard (550 pounds charging capacity) should be increased. Owners of such very small pot furnaces, i.e., less than one cubic foot of capacity, should not be bothered with conducting the performance tests and submitting the information required by EPA.	The only standard applicable to pot furnaces is the opacity standard. The owner of a pot furnace is not required to conduct the stack tests required of owners of blast (cupola) or reverberatory furnaces.
L-7	196	Emissions from bypasses should be controlled.	Such emissions are prohibited by a revision to subpart A of the General Provisions (40 CFR 60), which requires that all facilities subject to new source performance standards must be, to the extent practicable, operated and maintained in a manner consistent with good air pollution control practice for minimizing emissions.
L-8	62, 196	Fugitive dust emissions should be controlled.	See response to L-7.
L-9	62	New secondary lead smelters should be required to locate in areas where exposure of humans and domestic animals to lead fallout will be minimized.	Section 110 of the Clean Air Act requires the states to provide implementation plans that include a procedure for reviewing the locations of new sources and preventing their construction if attainment or maintenance of ambient air quality standards will be prevented thereby.
L-10	62, 196	The proposed standard should also apply to existing smelters.	This standard is promulgated under section 111 of the Clean Air Act, which applies only to new or modified sources. Existing stationary sources are regulated by implementation plans under section 110; these plans are formulated and enforced by the states but must be approved by EPA.
<u>Subpart M Secondary Brass and Bronze Ingot Production Plants</u>			
M-1	129	The brass and bronze ingot industry is not a significant source of air pollution, no new source performance standard should be promulgated for this industry.	As with all sources for which new source performance standards have been or will be specified, secondary brass and bronze ingot production plant emissions were considered first in the uncontrolled state. Certainly, uncontrolled, these plants would be significant sources of air pollution. The plants which operate today control emissions to various degrees. State and local regulations vary in the limitations imposed on such emissions. No single standard is accepted nationally. The best system of emission control is not found or required in all locations. The intent of new source performance standards is to ensure that future plants, and existing plants if they are substantially modified, apply, as required by section 111 of the Clean Air Act, "... the best system of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determines has been adequately demonstrated." Thus, a new or modified significant source of air pollution must apply the best system of emission control regardless of its location.
M-2	129, 150, 204	The visible emission standard should be changed because (1) condensed water vapor might be mistaken for emissions of particulate matter; (2) baghouses result in "no visible emissions" rather than in "less than 10 percent opacity", (3) there is no basis for the 2-minute/hour exemption; (4) there should be a maximum opacity allowed during exemptions, and (5) some normal operations last longer than 2 minutes and result in emissions above the standard.	See the discussion of opacity standards in Chapters 2 and 7 of this document (Volume 3).

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Comment no.	Commentator no.	Comment	Response
M-3	204	The term "reverberatory furnace" should not be used to define a reverberatory furnace. The definitions of electric and blast furnaces should also be revised.	The intent of the definition of reverberatory furnace was to identify the types of reverberatory furnaces covered by this regulation, the definition has been revised to clarify this intent. The definitions of electric and blast furnaces are considered adequate.
M-4	129	It is not clear if the performance test is to be conducted while the affected facility is operating at the maximum production rate or while the control device is operating at its maximum rate; conditions at a plant may differ since several affected facilities are sometimes vented to the same control device.	The intent is to test emissions while the air pollution control device is controlling emissions from the number of furnaces that it would normally control, these furnaces would then be required to operate at their maximum production rates. Where only some of these furnaces are affected facilities (i.e., new or modified furnaces), then the Administrator's representative at the test will determine representative conditions. Recent changes to the General Provisions (Subpart A) make it clear that the conditions for performance testing shall be specified by the Administrator.
M-5	129	EPA data were collected primarily from systems where a single furnace was controlled by the baghouse; it would be much more difficult to comply with the standard for systems ducting more than one furnace to a single control device. The present level of the standard (0.022 or/dscf) will probably preclude the use of the latter control system.	All the tests to support the standard were conducted under "normal" operation of the control device except for the tests of facility F, which was operating one furnace rather than the normal three of five furnaces ducted to the same control device. It is true that the test data used as a basis for the emission limits (A ₁ , B, and D) were collected with only one furnace in operation, however, this is "normal" for these plants. At Plant A, only one furnace was ducted to the control device; at Plant B, a single large (100 ton) reverberatory furnace and two small (3/4 ton each) electric furnaces were ducted to the control device, but only the large furnace normally operates so it was tested by itself, at Plant D, two reverberatory furnaces were ducted to a single baghouse with seven filter compartments, but normal plant procedure when operating only one furnace was to use only four of the seven compartments and this was the arrangement during the test. The economic analysis assumed a single furnace/control device system and showed no undue adverse economic impact on the industry. The multiple furnace/single control device system was mentioned only as a possible alternative, no evaluation as to the feasibility, either economically or technologically, was made.
M-6	204	What is the basis for exempting small furnaces (less than 1,000 kg/heat or 250 kg/hour) from the standard?	Small furnaces are normally operated only intermittently to produce specialty alloys and have lower emissions during production than do the larger furnaces. Emissions are not significant, and a baghouse is not economically justifiable on the basis of the data.
M-7	129	The tonnage figures shown in the test data summaries are not comparable, some are based on charge material while others are based on metal produced.	True. These data were presented for information only and were not a part of the basis for the emission limitation.
M-8	129	The test data on facility H show a variation of from 4100 scfm to 8000 scfm. The preliminary facility description states that two furnaces were in operation during the test. This fact is questioned based on such wide variations of the emission rates; perhaps only one furnace was in operation during part of the testing.	Two furnaces were in operation. The control system consisted of 3 baghouses. One venting the flue gases from both furnaces, one venting the charging door hoods, and one venting other emission points. The six test results represent two runs on each of the three baghouse stacks. The variations are from the different baghouses.
M-9	129	The cost of achieving a collection efficiency in excess of 99 percent, which is required to meet the proposed emission level, is not justified.	No supporting data accompanied this comment. EPA analysis shows that the cost of achieving the emission level is not sufficient to result in an undue adverse economic impact upon the industry.
M-10	129	The investment costs presented in the background document are low, possibly due to the omission of costs for flues, ducts, and installation.	The investment costs presented did include these costs, but the data were collected before 1971. It is possible that the costs today could be 10 to 15 percent higher due to general inflation.
M-11	197	Cadmium may be emitted from these plants and the test method may not measure it. Cadmium emissions should be controlled because inhaling cadmium can lead to ill health.	The proposed standard is not intended to control cadmium emissions. The effects of cadmium on health and methods for controlling cadmium emissions are currently being studied by EPA.

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Comment no.	Commentator no.	Comment	Response
M-12	129	The NSPS requires that testing be conducted in an undiluted gas stream or that the amount of dilution be determined by the source. This is not justified for the following reasons: (1) EPA tests were conducted in diluted gas streams with no attempt to correct results for such dilution, (2) dilution is necessary to cool the furnace gases to safe operating temperatures prior to the baghouse, (3) determining the amount of dilution would be extremely difficult and expensive since there are many points in the process where the air induced might be considered a diluent, (4) from the EPA data presented, it can be shown that the amount of dilution air used to cool the furnace gases will vary widely as a result of operator preference. The concentration standard proposed (0.022 gr/dscf) will encourage the use of more dilution, a standard of 0.05 gr/dscf would allow the source to use less dilution air and consequently might result in less mass emission of particulates.	The intent of requiring that tests for compliance with the standard be based on measurements of undiluted gases was to show that dilution could not be used for the purpose of complying with the standard. Since such a prohibition applies to all standards, this point is made in an addition to subpart A, General Provisions, which applies to all standards. Another recent change to the General Provisions also makes it clear that the conditions for performance testing shall be specified by the Administrator, and the use of air to dilute for the purpose of compliance will be disallowed in such specifications. See the discussion of dilution air in Chapter 2, General Considerations.
<u>Subpart H - Iron and Steel Plants</u>			
N-1	197, 150, 43	The visible emission standard should apply to the rooftop or secondary emissions as well as to primary emissions.	Secondary emissions result during tapping, charging, and hot metal transfer operations. Technology for control of these emissions was neither observed nor known to exist at any BOPF shop in the world, and an engineering assessment determined that the development of an emission standard was not technically feasible.
N-2	212	In order to comply with the proposed visible emission standard of less than 10 percent opacity, the control equipment would have to be designed to achieve emission concentrations considerably lower than the limit proposed (0.022 gr/dscf).	See the discussion of opacity standards in Chapters 2 and 8 of this document (Volume 3).
N-3	197, 212	The visible emission standard should be changed for the following reasons: (1) the opacity limitation is too lenient. It should specify a zero percent limit, and (2) the background document does not demonstrate that the 10 percent opacity limit is achievable, nor does it take into account the economic or environmental impact of the opacity limit as opposed to the concentration limit.	See the discussion of opacity standards in Chapters 2 and 8 of this document (Volume 3).

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Comment no.	Commentator no.	Comment	Response
N-4	43	The concentration standard set for particulate matter emissions is liberal in comparison to the Allegheny County regulation.	The form of the Allegheny County regulation does not support direct comparison with the new source performance standard. Allegheny County's regulation is a mass emission limitation applicable to many types of industrial sources, and it is based on a formula dependent upon empirical relationships developed locally. The emission limitation varies with charging rates. This approach to regulating emissions has considerable merit and can be applied well to defined local conditions. It is not practical to apply on a national scale to new sources.
N-5	212	The standard should be more explicit in its definition of dilution air. As presently worded, it is not clear whether or not combustion air is considered to be dilution air.	The intent of requiring that tests for compliance with the standard be based on measurements of undiluted gases was to show that dilution could not be used for the purpose of complying with the standard. Since this prohibition applies to all standards, this point is made in a change to subpart A, General Provisions, which applies to all standards. In addition, another recent change to the General Provisions makes it clear that the conditions for performance testing shall be specified by the Administrator, and the use of air to dilute for the purpose of compliance will be disallowed in such specifications. See the discussion of dilution air in Chapter 2, General Considerations.
N-6	193	Wording of the standard does not limit applicability only to emissions from the control device.	The standard is intended to apply only to emissions from the control device. The test method requires that emissions be sampled in either a stack or a duct. The outlet of the control device is the only logical location at which to sample.

Subpart O Sewage Treatment Plants

O-1	155	All tests should have been conducted while the units were operating at full capacity because reduced quantities of gas passing through the scrubber affect collection efficiency. Low feed rates make results from Plants B, C, and E questionable.	Low sludge feed rates in multiple-hearth incinerators do result in decreased gas flow rate through the scrubber. Impingement scrubber efficiency would be reduced under these conditions, but a venturi scrubber can be designed with an adjustable throat that maintains collection efficiency through a wide range of gas flow rates. Reduced scrubber efficiency does not, however, mean that emissions must increase at lower sludge burning rates. For example, for the three plants with impingement scrubbers (Plants B, C, and D) and the one plant with a cyclonic scrubber (Plant E), emissions in lb/ton of dry sludge varied not with percent of design feed rate but rather with amount of pressure drop. A designer of multiple-hearth units suggested that the effect of decreased gas flow through the scrubber is compensated for by reduced turbulence in the incinerator, which results in less fly-ash entrainment and lower inlet grain loading.
O-2	178	Test results show decomposition of chlorine-containing compounds in sludge during incineration. This is not discussed in the background report on environmental impact.	At the facilities tested, chlorine emissions (as HCl) were minor. For example, effluent gases at one of the facilities tested (Plant A) contained less than 10 ppm Cl. This amounts to less than 0.055 pound of chlorine per hour and will have little, if any, effect on the environment.
O-3	192	Impact of standard on ambient air quality is not discussed.	It is not practical or meaningful to make general determinations of changes in ambient air quality that might be caused by new or modified sources. EPA does not know where such sources will be built, and many specific factors, such as topography, meteorological conditions, proximity of other pollution sources, and quantities emitted from all sources, will have great impact on air quality in specific locations.
O-4	192	Technology is not really demonstrated to be available.	One plant tested (Plant A), a typical facility except for the more effective scrubber, easily met the new source performance standard.
O-5	192	It seems remarkable to note that the annual cost per person is 50 percent more where an incinerator must meet the new source performance standard instead of "typical local standard." Telling us that the proposed new standard costs \$0.04 per year more per person without stating that this is 50 percent more is hardly "truth in advertising."	As EPA data show, the cost of meeting the local standard is 8 cents per person per year and the cost of meeting EPA's standard is 12 cents per person per year. True, the additional 4 cents is a cost increase of 50 percent, but the actual amount remains insignificant. Percent figures are often misleading. In this case, expressing the increase in terms of 4 cents per person per year portrays the economic impact of the standard more clearly than does a percentage.

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0-6	155	Cost figures do not take into account (1) additional space required for a venturi scrubber, and (2) addition of an aftercooler.	Venturi scrubbers, normally installed vertically, require no additional floor space; floor space required by the extra pumps is not considered significant. An aftercooler is not considered necessary to meet the standard.
0-7	197	The standard should also regulate particulate emissions from scum-burning and ash-handling activities.	It was not considered necessary to specify that the standard applied to scum burning. Scum is usually incinerated along with sludge because it has a higher Btu content than sludge. Incineration of scum actually decreases the auxiliary fuel required per pound of material fed to the incinerator. At the well-controlled plants visited, ash-handling activities did not generate any visible particulate emissions.
0-8	197	It is not clear from the definition of sewage whether or not the standard is applicable to sludge incinerators in industrial sewage treatment plants.	The regulations have been revised to clarify that only municipal sewage sludge incinerators are affected by the standard.
0-9	204	An odor regulation is needed in addition to the particulate emission regulation. Multiple-hearth and some fluidized-bed incinerators emit odors because exhaust gases are not adequately exposed to high temperatures.	EPA assessed odors at both multiple-hearth and fluidized-bed incinerators. The absence of any odor problems indicates that the exhaust gases are adequately exposed to high temperatures.
0-10	252	Data in the January 1973 EPA Task Force Report on sewage sludge incinerators show that even well-controlled incinerators cannot meet the proposed standard.	The Task Force Report contained preliminary test results, some of which changed as calculations were checked. The corrected results, which were published in Volume 2 of this document show that sewage sludge incinerators can meet the standard.
0-11	178	The regulations include combustion air as dilution air. Treatment of EPA data in the background documents makes it obvious that EPA did not intend this. The regulations should be revised to allow combustion air to be added to the incinerator.	The regulations have been revised to (1) express the standard in pounds particulate per ton of dry sludge fed to the incinerator, and (2) delete the requirements concerning dilution air. This permits combustion air or dilution air to be added without invalidating the test because the test results in pounds per ton sludge are not affected by dilution.
0-12	113	The concentration standard needs a reference basis such as a correction to 12 percent CO ₂ .	Agree, because the amounts of combustion air and cooling air admitted to the system vary from plant to plant. EPA considered using CO ₂ content as a reference basis, but the scrubbers used to control particulate also absorb some of the CO ₂ . Mass emission units of pounds particulate per ton dry sludge were finally selected as the best approach to establishing a common reference basis because dilution of the exhaust gas does not affect actual mass emissions.
0-13	155	Is EPA saying that only venturi scrubbers can meet the standard?	No, but venturi scrubbers seem to be the most economical choice. Impingement scrubbers tested by EPA did not meet the standard but, in our best judgment, would do so if used in conjunction with an oxygen meter that automatically regulates fuel burning rate. In our best judgment, electrostatic precipitators could also provide more than adequate control. There are no EPA test data on either of these control systems because during the test program there were no existing plants using them.
0-14	155	EPA states on page 60 of the background document that control equipment manufacturers will guarantee 0.03 grain per dry standard cubic foot. What are the manufacturers' names?	EPA has removed this statement from the background document. Some manufacturers stated to EPA that their systems could meet the standard, but have provided no specific, written guarantees. Because one of the incinerators tested by EPA meets the standard, lack of guarantees does not imply inability to meet the standard.
0-15	155	How does the Massachusetts regulation (0.05 grain per dry standard cubic foot at 12 percent CO ₂) compare to EPA's regulation (0.031 grain per dry standard cubic foot)?	EPA took CO ₂ data from all incinerators tested, but found that the percentage of CO ₂ varied from plant to plant and from test to test. This variation, sometimes significant, precludes any direct comparison of the two standards.

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Comment no.	Commentator no.	Comment	Response
Test Methods			
TM-1	94, 204	Delete use of "alternative test methods."	Commentators have misinterpreted the intent of allowing alternative methods. The misinterpretation is due in part to the wording in the Preamble to the proposed Group II standards, where two examples of alternative methods were given. These examples imply that a wide range of alternatives is possible with use of suitable correction factors. In actuality, correction factors may be difficult to obtain without inordinate amounts of testing. The intent of allowing alternative methods was to reduce the complexity and cost of source testing where such reductions would not significantly increase the chances of violating the standard. Determination of the acceptability of a proposed alternative method would be made by the Administrator after an intensive review of the proposed method, the source, the control system, the operator, and comparative data.
TM-2	143, 176, 182, 222	The regulations for individual affected facilities should specify that the use of alternative or equivalent test methods is allowed.	Agreed. The appropriate section of each subpart has been revised to indicate that equivalent or alternative methods are allowed.
TM-3	221	The General Provisions concerning performance tests should be changed to: (1) include industry-accepted test methods as equivalent, (2) revise the wording associated with alternative method from "adequate for indicating" to "reasonably indicate," and (3) require EPA to publish alternative test methods in the Federal Register.	(1) Industry-accepted methods should not be accepted without due evaluation by EPA. A source may use equipment or procedures that have been found to yield invalid results; some mechanism for checking these procedures must be available. (2) The word change does not seem to alter the meaning or intent of the proposed regulation. (3) This procedure has been considered by EPA. However, a multiplicity of alternative methods may be proposed, and publishing of all may well prove too voluminous to be reasonable. Instead, EPA now plans to publish on a periodic basis in the FEDERAL REGISTER a list of sources for which alternative methods have been approved. Further information could then be obtained upon request. No specific references to these procedures are deemed necessary in the regulations.
TM-4	125	Iodine number flasks should not be used because sampling errors are greater than with plain flasks.	The term "iodine number flask" is confusing; nomenclature has been changed to "iodine flask" for clarity.
TM-5	251	Normal cubic meter generally refers to a cubic meter at 0°C and 760 mm Hg, but EPA has defined normal conditions as 21.1°C and 760 mm Hg.	"Normal cubic meter" has been changed to "dry cubic meter at standard conditions" (dscm), with standard conditions defined as 20°C and 760 mm Hg.
TM-6	250	The definition of particulate matter implies a return to the entire train; i.e., front half and back half, for these regulations.	This was not the intent, and EPA feels that we did not so imply.
TM-7	239	When a specific test method is cited, reference to its location in the FEDERAL REGISTER should be included.	Referencing one specific FEDERAL REGISTER publication would not be prudent. Test methods quite often undergo changes for clarification and simplification, and reference to any specific version would hamper adoption of new or better procedures.
TM-8	174, 234	Typographical and other errors in Methods 10 and 11.	Corrected.
TM-9	129	Dilution air should be allowed.	The intent of requiring that tests for compliance with the standard be based on measurements of undiluted gases was to show that dilution could not be used for the purpose of complying with the standard. Since such a prohibition applies to all

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Comment no.	Commentator no.	Comment	Response
			standards, this point is made in a change to subpart A, General Provisions, which applies to all standards. In addition, another recent change to the General Provisions makes it clear that the conditions for performance testing shall be specified by the Administrator; the use of air to dilute for the purpose of compliance will be disallowed in such specifications.
TM-10	133	Minimum training should be required for test personnel.	The comment has merit but would be very difficult to implement. Sampling capability is greatly dependent upon experience, much less so on education. Further, published procedures are very detailed, so that operator judgment is held to a minimum. Finally, a test team will typically consist of at least a leader and an operator, with larger tests requiring proportionately larger teams, the more people involved, the less the inexperience of one person will affect the results. This is in contrast, for example, with an opacity reader who typically works alone and therefore is required to update his skills periodically.
TM-11	255	Permissible isokinetic variation should be ± 20 percent.	This recommendation is based on theoretical work by the commentator. This approach was initially used (36 FR 15704) and then changed (36 FR 24876) to the present method. The original method was based on attempts to ensure concentration results within ± 10 percent. However, evaluation of data from hundreds of tests showed that ± 10 percent isokinetic can be maintained virtually all of the time. Concentration results are thus within ± 5 percent. The comment was made after evaluation of EPA data indicated that the EPA requirement of ± 10 percent isokinetic had not been met in some instances. Reevaluation of those specific test results showed that the original reports were in error and that ± 10 percent had in fact been achieved.
TM-12	163	Method 10: (1) Illustrations and descriptions of sampling devices and trains are inadequate. (2) Use of the grab-sampling train is not clear. (3) Purging provision are inadequate. (4) The sampling train can be dangerous if the sample inlet line is blocked during calibration. (5) Orsat analysis could be eliminated by using solid absorbers for H_2O and CO_2 determination.	(1) The descriptions are believed to be adequate by EPA engineers. (2) The term "grab sampling" is misleading. It has been changed to "continuous sampling." (3) The purging requirements are the same as those defined in Method 3 and have been used successfully for many years. (4) Agreed, but the possibility of this happening is very remote. (5) This procedure was initially proposed and used but was later changed because it was believed accuracy might be poor at low concentrations of water and CO_2 . Further consideration of the entire procedure resulted in the conclusion that the solid absorbers should be included as alternatives to Orsat analysis, and the regulation has been revised accordingly.
TM-13	125, 247	Method 10 is not specific enough as to when initial zero and span checks should be made.	The test method specifies that these operations are to be performed both before and after the test.
TM-14	148	Method 10 (1) Much better performance specifications are attainable with his equipment, and (2) the H_2O and CO_2 traps could be eliminated with such equipment.	Item (1) of the comment is probably true, however, the purpose of defining performance specifications is not to reflect best available instrumentation, but rather to establish minimum acceptable performance criteria. Item (2) is probably not true at the observed stack concentrations.
TM-15	197	For method 10, calibration gases should be chemically calibrated.	EPA considers the chemical methods recommended to be less accurate than those employed by the manufacturers. Calibration certification by the manufacturer is now specified in the regulation.
TM-16	166	The sample time specified in subpart J, Petroleum Refineries, does not agree with that given in method 11.	True. Subpart J has been changed to be consistent with method 11.

APPENDIX E (continued). SUMMARY OF COMMENTS AND RESPONSES PERTINENT TO NEW SOURCE PERFORMANCE STANDARDS (40 CFR 60) PROPOSED IN FEDERAL REGISTER OF JUNE 11, 1973 (38 FR 15406)

Comment no.	Commentator no.	Comment	Response
TM-17	163	Method 11: (1) The midget sampling train is not efficient. (2) Universal Oil Products (UOP) method 212-72 should be used instead of method 11.	(1) EPA has performed tests to evaluate collection efficiency, and 100 percent efficiency was obtained in tests using about 500 ppm H ₂ S. (2) An evaluation of the proposed method indicates that it may well be acceptable, although it may be more cumbersome and difficult to use than method 11. The commentator has the option of submitting his method to EPA as an equivalent or alternative method.
TM-18	212, 247	Recommend use of Inter-society Committee (IC) Method 701 in place of method 11 because with method 11 the sampling time is too long and interference can bias the results	The IC method may well be equivalent and may be approved as such upon presentation of data. However, method 11 was used for the EPA tests and it must continue to be the reference method, or all tests will have to be repeated. EPA evaluations indicate that SO ₂ is the only major potential interferent at this source. Therefore, method 11 was modified by adding a fifth impinger to remove any SO ₂ . The effect of this change was verified in a series of laboratory tests.
TM-19	143, 166, 176, 182	Monitoring instruments do not need zero adjustment and calibration every 24 hours, as required for emission monitoring in subpart J, Petroleum Refineries. The regulation should instead require that these operations be performed only as often as necessary or that the instrument be kept in proper operating condition to meet allowable tolerances	This requirement may not be strictly applicable or necessary for all instruments. However, assurance is needed that zero and calibration are being maintained on at least a daily basis. The procedures for this vary with the type of instrument involved. In some cases zero and calibration may be automatic or may be inherent in the instrument, in some cases, zero and calibration can be performed manually with minimal effort, and in some cases zero and calibration checks are more difficult. To date, EPA has not evaluated or utilized instruments in this application, and we are therefore not able to provide a more definitive calibration specification, or to provide for any exceptions. A program is currently being undertaken to obtain needed information. On the basis of this, further guidance or a revision in the zero and calibration requirement will be provided.

APPENDIX F. ERRATA FOR
BACKGROUND INFORMATION FOR PROPOSED
NEW SOURCE PERFORMANCE STANDARDS:
VOLUME 1, MAIN TEXT (APTD-1352a)

<u>Page no.</u>	<u>Paragraph no.^a</u>	<u>Line no.</u>	<u>Correction</u>
INTRODUCTION			
2	3	7	Last word of line should be "no" instead of "not"
4	Table 1	-	The first number in the second column (Allowable emission rate) should be "0.30" instead of "0.03"
5	2	2	Change "all" to "these"
5	3	4	Change "all" to "these"
ASPHALT CONCRETE PLANTS			
9	3	2	The number "0.03" should be "0.031"
9	Figure 1	-	Caption should read: "Partially controlled hot-mix asphalt concrete plant."
9	Figure 1	1	The label "HOT SCREENS" should be "HOT AGGREGATE SCREENS"
10	2	1-3	Delete the first sentence and replace it with the following: "The proposed standard requires that emissions from a plant with only a cyclone dust collector be reduced by about 99.7 percent. The proposed standard can be met by using fabric filters or medium-energy venturi scrubbers, normally preceded by a cyclone or multiple cyclone, to collect dust from the dryer (Figure 2)."
10	Figure 2	-	The label "HOT SCREENS" should be "HOT AGGREGATE SCREENS"
10	Figure 2	-	The duct leading from PRIMARY DUST COLLECTOR TO BAGHOUSE should not have a duct leading from it to MINERAL FILLER FINES STORAGE

^aA partial paragraph beginning a page is designated paragraph no. 1.

<u>Page no.</u>	<u>Paragraph no</u>	<u>Line no.</u>	<u>Correction</u>
10	4	1	Change "(0.031 dscf)" to "(0.031 gr/dscf)"
11	1	3	Change "Eight" to "Seven"
11	1	4	Add the following as the last sentence of the paragraph: "One plant scheduled for testing closed for the winter before the arrival of the EPA test crew."
11	2	2	Change "Nine" to "Eight"
11	3	1	Delete the parenthetical material: "(three samples per test)"
12	4	7	Change reference number from "5" to "4"
12	5	2	The number "0.030" should be "0.020"
12	6	3-5	Delete lines 3-5 ("The replacement... change in fuels.")
12	8	7	Change reference numbers from "1, 5-9" to "1, 6, 8, 9, 10"
12	8	9	Change "such" to "so"
12	8	10	Change line to read: "from baghouses are nearly the same over the wide variety of aggregate feedstocks typically used by asphalt concrete plants. ^{5, 8-13} This is further"
13	1	6	Change "...aggregate was used..." to "...aggregate fines were used..."
13	1	7	Delete the phrase "of only 4.5:1." and insert in its place the following: "of more than 50 times less than the proposed standard."
13	3	3	Change "collection, maintenance, and operation" to "collector maintenance and operation"
13	3	4	Change "...require installation and proper maintenance..." to "...require proper installation, operation, and maintenance..."
13	5	1	Change "10" to "about 6.6"
13	5	2	Change the period after "years to a comma and insert the following: "and new plants have been installed at the rate of 250 to 260 per year. ¹⁶ "

<u>Page no.</u>	<u>Paragraph no.</u>	<u>Line no.</u>	<u>Correction</u>
13	5	3	Change "increase" to "increased"
13	5	6	Insert reference number "16" at end of paragraph.
14	2	3	Delete the phrase "for either size plant" and insert in its place "for a given size plant"
14	5	2	Change "...new plant should..." to "...new plants should..."
15	-	-	Insert reference 16 as follows: "16. A Systems Analysis of the Production and Laydown of Hot Mix Asphalt Pavement. Texas Engineering Experimental Station, Texas A&M University, College Station, Texas. 1970 study funded by NAPA. p. 41."
15-16	-	-	Change reference numbers 16 through 22 to reference numbers 17 through 23.

PETROLEUM REFINERIES, FLUID
CATALYTIC CRACKING UNITS

19	5	1	Change "three" to "four"
19	5	3	Change "average" to "averaged"
19	5	3	Change "three" to "two"
21	2	1	Change "three" to "four"

PETROLEUM REFINERIES, BURNING
OF GASEOUS FUELS

25	1	4	Insert a period after "releases" and delete "or to the burning of liquid or solid fuels in the same heaters and boilers."
26	3	3	The number "13" should be "10"
27	1	6	The number "13" should be "10"
27	3	7-8	Insert a period after "disposal" and delete "by incineration or landfill."
28	1	4	Change "discernable" to "discernible"
28	1	5	The number "13" should be "10"

STORAGE VESSELS FOR
PETROLEUM LIQUIDS

No corrections

<u>Page no.</u>	<u>Paragraph no.</u>	<u>Line no.</u>	<u>Correction</u>
			SECONDARY LEAD SMELTERS AND REFINERIES
			No corrections
			SECONDARY BRASS OR BRONZE INGOT PRODUCTION PLANTS
45	1	3	After "...(cupola) furnaces." insert the following two sentences: "Figure 21 shows two types (stationary and rotary) of reverberatory furnaces operating at the same plant since this arrangement is typical in medium-to-large plants; the stationary type can be designed to produce much larger batches of metal, but the rotary type is more economical when the demand is for smaller quantities of a particular alloy of brass or bronze. Blast furnaces (cupolas) are normally found only at the larger plants where it becomes practical to recover metal from the slag of the reverberatory furnaces; electric furnaces are alternatives to rotary-type reverberatory furnaces."
45	2	2	Change "blast" to "reverberatory"
45	2	3	Change "reverberatory" to "blast"
45	2	3	Change "less" to "more"
45	5	1	Delete parenthetical material: "(Figure 21)"
45	5	8	Change "Emissions from electric furnaces are..." to "The composition of emissions from electric furnaces is..."
45	5	9	Delete the words "process and"
45	6	2	Change "...scrubber has..." to "...scrubber or electrostatic precipitator has..."
45	6	4	Change "scrubbing" to "this control"
46	Figure 21	-	The label "REVERBATORY FURNACE" should be "STATIONARY FURNACE"
46	Figure 21	-	The caption should read: "Controlled secondary brass and bronze reverberatory furnaces."
46	4	4	Change "plant" to "control equipment"

<u>Page no.</u>	<u>Paragraph no.</u>	<u>Line no.</u>	<u>Correction</u>
46	6	1	Change "...at each plant. The tests..." to "...at each plant where the tests..."
47	1	3	Change "tests" to "individual sample results"
47	2	2	Delete the number "0.0125" and insert in its place the numbers "0.012, 0.013," so that the line reads: "0.002, 0.005, 0.010, 0.012, 0.013, 0.014, and 0.017 gr/dscf..."
47	3	2-3	Delete last sentence of paragraph ("No visible...by EPA.") and replace it with the following: "Plants E and F, which were previously tested by EPA, were observed to have no visible emissions."
47	4	1	Between "gr/dscf" and semicolon, insert the following phrase: "using test code method 4"
47	4	4	Delete "is similar." and insert "and composition of emissions are similar, and the uncontrolled emission rate is less from an equivalent-size electric furnace. During an EPA inspection of an electric furnace facility, the facility was operating with no visible emissions."
IRON AND STEEL PLANTS			
50	8	1	Delete "that are specifically for" and replace with "applicable to"
50	8	2	Delete "0.1 to 0.2...0.090 gr/scf" and replace with "0.01 to 0.09 gr/scf."
50	8	3	Change "77" to "17"
50	8	4	Change "Section" to "section"
SEWAGE TREATMENT PLANTS			
57	1	3	Insert "municipal" between "all" and "sewage"
59	2	3	Change "previsous" to "previous"

APPENDIX G. ERRATA FOR
BACKGROUND INFORMATION FOR PROPOSED
NEW SOURCE PERFORMANCE STANDARDS:

VOLUME 2, APPENDIX: SUMMARIES OF TEST DATA (APTD-1352b)

Page No.

Correction

HOT MIX ASPHALT CONCRETE PLANTS

Change indicated numbers in tables as follows:

7

Table A-1. ASPHALT CONCRETE FACILITY A₁

Run number	1	2	3	Average
	*	*	*	
Stack Effluent				
Flowrate, dscfm	17,333	17,122	17,548	17,344
Flowrate, dscf/ton product	9,285.5	11,543	10,743.6	10,432
	*	*	*	
Particulate emissions				
Probe and filter catch				
	*	*	*	
lb/hr	0.85	1.11	1.01	0.99
lb/ton of product	0.0135	0.018	0.016	0.016
Total catch				
	*	*	*	
lb/hr	4.05	2.78	2.76	3.21
lb/ton of product	0.065	0.044	0.044	0.051
	*	*	*	

9

Table A-3. ASPHALT CONCRETE FACILITY B

Run number	1	2	3	Average
	*	*	*	
Stack effluent				
Flowrate, dscfm	22,375	22,392	23,907	22,891
Flowrate, dscf/ton product	6,613	6,785	6,078	6,469
	*	*	*	
Particulate emissions				
Probe and filter catch				
	*	*	*	

<u>Page No.</u>		<u>Correction</u>			
9 (continued)	1b/hr 1b/ton of product Total catch	1.53 0.007	1.92 0.01	1.32 0.006	1.59 0.007
		*	*	*	
	1b/hr 1b/ton of product	19.31 0.095	10.54 0.053	3.42 0.014	11.09 0.052
		*	*	*	
11	Table A-5. ASPHALT CONCRETE FACILITY D				
	Run number	1	2	Average	
		*	*	*	
	Stack effluent				
	Flowrate, dscfm	25,213	25,361	25,287	
	Flowrate, dscf/ton product	6,845	6,503	6,465	
		*	*	*	
	Particulate emissions				
	Probe and filter catch				
		*	*	*	
	1b/hr 1b/ton of product Total catch	2.61 0.012	4.88 0.021	3.75 0.016	
		*	*	*	
	1b/hr 1b/ton of product	11.1 0.05	27.84 0.119	19.4 0.085	
		*	*	*	
15	Table A-9. ASPHALT CONCRETE FACILITY H ₁				
	Run number	1	2	3	Average
		*	*	*	
	Stack effluent				
	Flowrate, dscfm	30,002	29,887	27,969	29,286
	Flowrate, dscf/ton product	10,228	9,291	9,871	9,762
		*	*	*	
	Particulate emissions				
	Probe and filter catch				
		*	*	*	

15 (continued)	lb/hr	7.98	8.70	6.99	7.89
	lb/ton of product	0.045	0.045	0.041	0.044
	Total catch				

* * *

	lb/hr	12.75	27.79	13.29	17.94
	lb/ton of product	0.072	0.144	0.078	0.100

* * *

PETROLEUM REFINERIES
FLUID CATALYTIC CRACKING UNITS

23 Facility C: Delete last sentence ("During ...unit.") and replace it with the following: "The electrostatic precipitator consisted of two identical parallel precipitators vented to separate stacks. During the test, a malfunction occurred in one precipitator, invalidating the particulate test results obtained on stack B. Data analyses are thus based on particulate test results obtained on stack A."

23 Facility D: On line 5 after "occurred" and before the comma, insert the phrase "in the carbon monoxide boiler"

28 Table A-19: Delete reference to footnote b on "Particulate emissions" and add reference to footnote b to the particulate emission numbers listed under stack B. That section of the table then reads as follows:

Particulate emissions
Probe and filter catch

gr/dscf	0.0380	0.1066 ^b	0.0369	0.0589 ^b	0.0352	0.0450 ^b	0.0367	0.0702 ^b
gr/acf	0.0182	0.0499 ^b	0.0167	0.0282 ^b	0.0169	0.0213 ^b	0.0173	0.0331 ^b
lb/hr	29.7	85.5 ^b	27.8	49.0 ^b	27.4	36.5 ^b	28.3	57.0 ^b

Total catch

gr/dscf	0.2366	0.2092 ^b	0.2159	0.1776 ^b	0.2088	0.1775 ^b	0.2204	0.1881 ^b
gr/acf	0.1136	0.0979 ^b	0.0978	0.0851 ^b	0.1006	0.0840 ^b	0.1040	0.0890 ^b
lb/hr	184.8	167.8 ^b	162.5	148.0 ^b	162.7	143.8 ^b	170.0	153.2 ^b

28 Footnote b: Add the phrase "for stack B." to the end of the footnote.

29 Table A-20: Add footnote reference to title as follows: "CATALYTIC CRACKING FACILITY D, SUMMARY OF RESULTS^a"

29 Add footnote below table as follows: "^aMalfunction of test equipment invalidated particulate test results."

SECONDARY LEAD SMELTERS AND REFINERIES,
BLAST AND REVERBERATORY FURNACES

33 Table A-22: The numbers in the category "Visible emissions, % opacity" for run number 2 should be "10 to 20" instead of "10 to 70"

SECONDARY BRASS AND BRONZE REFINING

- 42 Facility B: Add the following sentence to the end of the description: "Baghouse also controls emissions from two small (1500 lb) electric furnaces, but they are not normally used and were not used during the tests."
- 42 Facility D: Add the following sentences to the end of the description: "Two furnaces are ducted to the baghouse, but only one was in operation during the test. Only four of the seven baghouse compartments are normally used when a single furnace is operating and this procedure was followed during the tests."
- 43 Facility E: Add the following sentence to the end of the description: "Baghouse also controls emissions from two other gas-fired 100-ton reverberatory furnaces that were not operating during the tests."
- 43 Facility F: Add the following sentences to the end of the description: "Baghouse also controls emissions from four other rotary furnaces that were not operating during the tests. Typically, three of the five furnaces operate at once."
- 43 Facility I: Add the following sentence to the end of the description: "Baghouse also controls emissions from three other rotary furnaces that were not operating during the tests."
- 44, 46 Tables A-31 and A-33: The numerical entries for the side heading "Visible emissions, % opacity" should be 0 instead of <10.
- 46, 47, 48 Tables A-33, A-34, and A-35: Delete the side heading "Excess air at sampling point, %" and its numerical entries.
- 48 Table A-35: The numerical entries for the side heading "Emissions, % opacity" should be 0 instead of <10 for runs 2 and 3.
- 49 In footnote a, "analysed" should be changed to "analyzed"
- 51 Table A-38: Add to the end of the table title a superscript "a"; then add footnote a at the bottom of the table as follows: "a Tested using Code Method 4."

IRON AND STEEL MILLS

No corrections

SEWAGE TREATMENT PLANTS

No corrections

TECHNICAL REPORT DATA		
(Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA-450/2-74-003	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE BACKGROUND INFORMATION FOR NEW SOURCE PERFORMANCE STANDARDS: Asphalt Concrete Plants, Petroleum Refineries, Storage Vessels, Secondary Lead Smelters and Refineries, Brass and Bronze Ingot Production Plants, Iron and Steel Plants, and Sewage Treatment Plants. Volume 3, PROMULGATED STANDARDS.	5. REPORT DATE February 1974	6. PERFORMING ORGANIZATION CODE
	8. PERFORMING ORGANIZATION REPORT NO.	
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Environmental Protection Agency Office of Air Quality Planning and Standards Research Triangle Park, N.C. 27711	10. PROGRAM ELEMENT NO.	11. CONTRACT/GRANT NO.
	12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES		
16. ABSTRACT This volume is the third in a series on standards of performance for asphalt concrete plants, petroleum refineries, storage vessels for petroleum liquids, secondary lead smelters, brass and bronze ingot production plants, iron and steel plants, and sewage treatment plants. The first two volumes gave background information and the data base for the proposed standards. This volume presents the promulgated standards and the rationale for any changes that were made, with particular attention to the problems of opacity and dilution air. Major comments received during the period for public comment are discussed where appropriate and are summarized with Agency responses in the appendix. The appendix also contains a list of commentators, new data for asphalt concrete plants, revised economic analyses for asphalt concrete plants and petroleum refineries, and errata for Volumes 1 and 2.		
17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air pollution Pollution control Performance standards Asphalt concrete plants Petroleum refineries Lead smelters and refineries	Brass ingot production Bronze ingot production Steel production Sewage treatment	Air pollution control
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