ANL-76-XX-11

COAL SUPPLY AND AIR QUALITY LIMITATIONS ON FOSSIL-FUELED ENERGY CENTERS

by

Albert E. Smith, Thomas D. Wolsko, and Richard R. Cirillo

August 1976

ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS

operated under contract W-31-109-Eng-38 for the
U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue
Argonne, Illinois 60439

COAL SUPPLY AND AIR QUALITY LIMITATIONS ON FOSSIL-FUELED ENERGY CENTERS

by

Albert E. Smith, Thomas D. Wolsko, and Richard R. Cirillo

Energy and Environmental Systems Division

Prepared under
Nuclear Regulatory Commission Activity #01-19-01

August, 1976

NRC Project Officer: Jack Roberts

Office of Special Studies

Washington, D. C.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (Contd.)

LIST OF TABLES

FOREWORD

Argonne National Laboratory was authorized by the U.S. Nuclear Regulatory Commission in response to the general requirements of the Energy Reorganization Act of 1974 to study siting potential for a range of fossil energy centers and to provide perspective on the relationship of coal and nuclear energy centers. The aim of this work is to present the results of an initial screening for areas most likely to provide suitable FEC sites, not a definitive determination of possible sites. It was incomplete at the time that the Nuclear Energy Center Site Survey-75 was issued on January 19, 1976.

The report also deals with aspects of prevention of significant deterioration (PSD) currently under legislative development and attempts to bracket possible ranges of legislative action. It is recognized that other criteria might exist and hence conduce to a different set of report conclusions.

Should additional work on coal-fired, energy-center siting be pursued, it would have to acknowledge the final form of requirements for PSD. In addition, the assumptions on fuel transportation by either water or land would need to be reexamined in the light of ongoing events and changing economics.

LIST OF ACRONYMS AND SYMBOLS USED

AQMA	-	Air Quality Maintenance Area
C	-	Electric generating capacity (Mwe)
FEC	-	Fossil energy center
FGD	-	Flue gas desulfurization
H	-	Heating value of coal (10^3 Btu/lb)
NAAQS	-	National Ambient Air Quality Standards
NSPS	-	New Source Performance Standards
PSD	-	Prevention of significant deterioration
S	-	Sulfur content of coal (%)
SAROAD	-	Storage and Retrieval of Aerometric Data
TSP	-	Total suspended particulates or particulates
UA	-	Urbanized Area
η	-	Efficiency of flue gas desulfurization

COAL SUPPLY AND AIR QUALITY LIMITATIONS ON FOSSIL-FUELED ENERGY CENTERS

Albert E. Smith, Thomas D. Wolsko, and Richard R. Cirillo

ABSTRACT

The coterminous United States is screened on a county-by-county [illegible] to identify areas most likely to provide sites [illegible] energy centers (FECs) utilizing local coal having capacities between 5,000 and 20,000 MWe. Areas eliminated as potential sites include national public lands excluded by legislation, urbanized areas, Air Quality Maintenance Areas for particulates and SO_2, and counties where air quality data indicate violations of particulate or SO_2 ambient standards. The remaining counties are further screened for suitable coal reserves. The quality of coal required for an FEC to meet emissions and ambient standards is determined for sulfur content and heating value. Based on Bureau of Mines coal reserve data, counties in areas with not enough quality reserves to support an FEC are eliminated. Areas most likely to provide sites for FECs of 5, 10, and 20 x 10^3 MWe, in two different spatial configurations, each with and without flue gas desulfurization are determined and mapped. The possible impacts of regulations for the prevention of significant deterioration are illustrated.

EXECUTIVE SUMMARY

The Energy Reorganization Act of 1974 requires the Nuclear Regulatory Commission to consider relevant alternatives when locating possible sites for nuclear energy centers. One alternative is a coal-fired fossil energy center (FEC). This study assesses the coal supply and air quality limitations on such centers.

An analysis methodology is developed that considers several indicators of existing air quality and the potential air quality impacts of FECs. The latter are used, along with emission and ambient constraints, to determine the sulfur content and heating value limitations on acceptable coals. The approach taken is to screen out areas with existing negative factors and to examine the remaining areas for adequate coal reserves. The result is a nationwide, county-by-county display of areas most likely to provide suitable FEC sites.

Twelve representative FECs are considered in the analysis. These are chosen to illustrate the effect on likely siting areas of the following: electric generating capacity, compact or spread-out configuration, and efficiency of flue gas desulfurization (FGD). Specifically, likely siting areas for 5-, 10-, and 20,000-Mwe FECs are determined. In making these determinations, programs for the attainment and maintenance of National Ambient Air Quality Standards (NAAQS) and enforcement of emission-limiting federal New Source Performance Standards (NSPS) are treated. The potential effects on siting areas of alternative approaches to the Prevention of Significant Deterioration (PSD) of air quality are also illustrated.

The first analysis phase considers FECs as generic air pollution sources and concludes that siting is unlikely in areas with indications of high particulate or sulfur dioxide levels. High short-term particulate levels are found to offer the greatest constraint.

In the second phase of analysis, the air quality impacts of the representative FECs are modeled and areas are identified in which both the ambient and emission standards could be met with the use of local coals. Figure ES-1 presents results for the least-constrained case, a 5000-Mwe center with 80%-efficient FGD. As center capacity increases, progressively smaller portions of these areas appear likely to provide sites. A significant reduction in site areas is found to occur when FGD is not used; additional site areas would be found if more efficient FGD were assumed. The analysis also shows that the likely siting areas for the two configurations are equivalent for smaller centers, but are greater for the spread-out centers when capacity exceeds 7000 Mwe. The combined effect of these three factors is sufficient to preclude siting a 20,000-Mwe FEC, unless either FGD is used or the center is built in the spread-out configuration.

In the final analysis phase, the reduction in likely siting areas under PSD programs is examined. Using the discussion drafts of September, 1975, as guides, it is determined that PSD regulations would place more stringent ambient constraints on FECs than are imposed by the national standards. Such programs have not yet been implemented, but they are determined to be potentially the most severe restriction on likely FEC siting areas. Implementation of the moderate Class II PSD limits might require even small FECs to use flue gas desulfurization. The analysis concludes that the impacts of Class I or

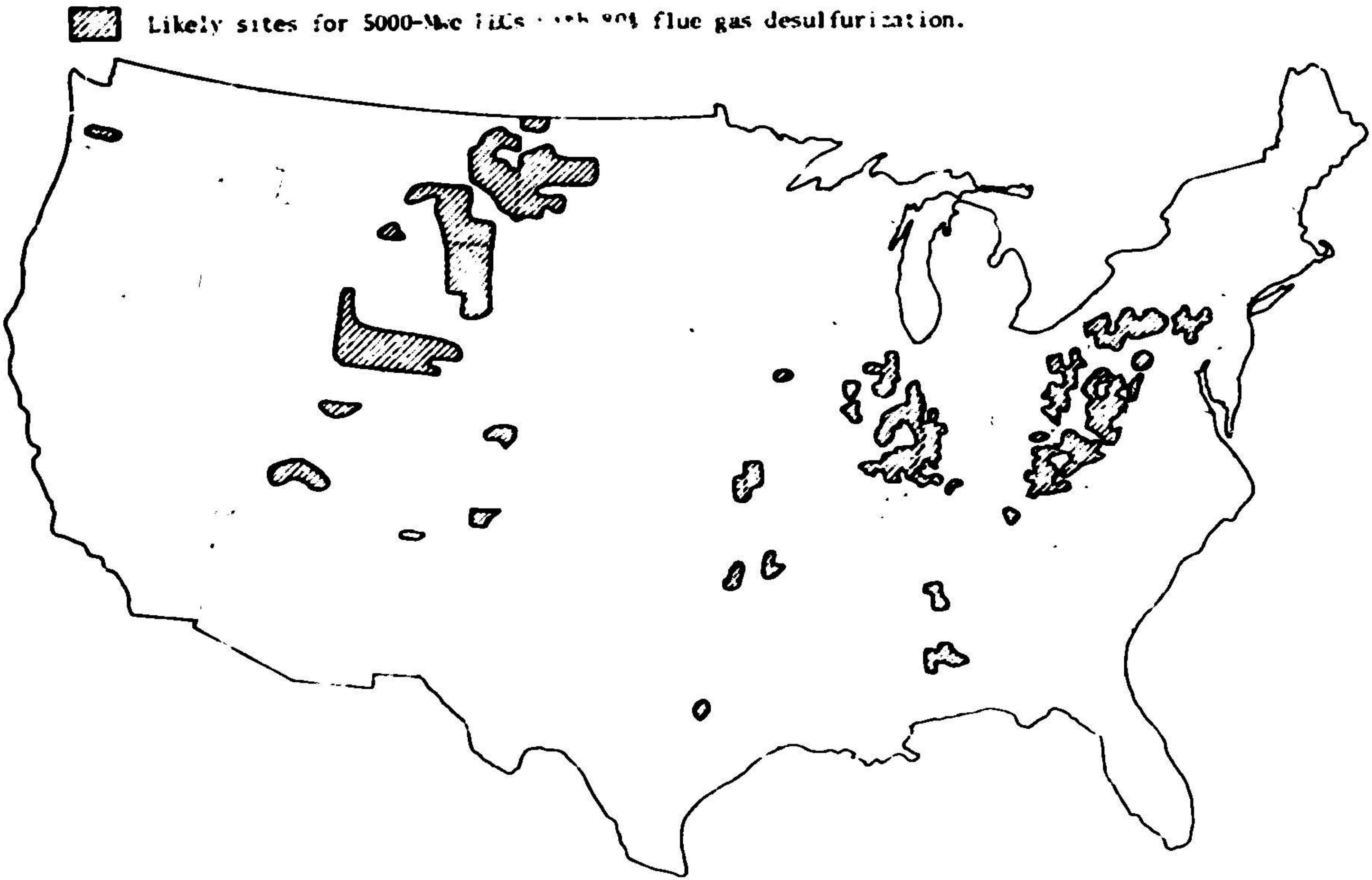


Fig. ES-1 Areas Most Likely to [illegible] Suitable [illegible]C Sites pristine areas extend far beyond their borders and that some alternatives presently being considered for Class I designations could preclude siting even small FECs unless RD with 90% or greater efficiency were used. The Class III designation requiring air quality to meet the national ambient standards gives the greatest range to likely FEC sites.

Other significant limitations beyond those specified in this study - coal availability and air quality - ought to be noted. Among these are water availability and proximity to load centers, conversion, cleaning, or blending of coal prior to combustion; transportation of coal for distances greater than about 60 miles; or the economic recoverability of the coal reserves. Also to be noted is that the air quality impacts of FECs were estimated by scaling modeled results rather than modeling each size of center separately and that no account was taken of local terrain.

1. INTRODUCTION*

Environmental and natural resource constraints recently have been imposed upon the traditional site-selection decisions of public utilities, which, together with the governmental regulatory agencies, are required to develop detailed environmental impact statements for each proposed site. Concern for the consequences of nuclear power generation has led to a particularly lengthened siting process, making consideration of a small number of high capacity energy centers a reasonable alternative to consideration of a large number of small capacity plants.

In response to the increasing difficulty in finding acceptable sites for energy facilities, Section 207 of the Energy Reorganization Act of 1974 directs the Nuclear Regulatory Commission to locate possible sites for nuclear energy centers. Part 3a of Section 207 calls for consideration of other "relevant factors," among which is the alternative of a fossil energy center (FEC) utilizing coal as a fuel. The use of coal in an FEC also accords with the national goal of energy self-sufficiency expressed in Project Independence.

Other work[1] suggests that the siting of a coal-fired FEC may be limited by such factors as fuel supply, environmental impacts, and the implementation of regulations for the prevention of significant deterioration (PSD). This report screens the coterminous United States for areas in which correlative considerations of air quality and coal availability indicate that suitable FEC sites are unlikely. In addition to air quality constraints based on existing pollutant concentrations, the presumed air quality impact of FECs are modeled and used to determine the sulfur content of coal that will achieve compliance with air pollution regulations. The availability of adequate reserves of coal is assessed in turn to determine the likelihood of finding a suitable site. The categories used as screens are

National public lands designated by legislation,
Urbanized Areas,
Air Quality Maintenance Areas,
Particulate air quality,

---

*For reader convenience, the figures and tables have been assembled at the back of the report and both are numbered consecutively.

Sulfur dioxide air quality,
Location and quantity of coal reserves, and
Sulfur content of coal reserves.

The potential impacts of PSD are also considered. Recent litigation has led the U.S. Environmental Protection Agency to promulgate pertinent regulations. However, proposals to change them are being considered in Congress. The situation regarding PSD is now fluid and the regulations are not being implemented; their potential impact on FEC siting is considered separately from the other screens.

2. METHODOLOGY

Two techniques were employed in the screens. The first was cartographic; areas eliminated as potential sites were mapped and then combined by overlaying the separate maps. The second was analytic and assessed FEC coal requirements and coal availability. The figures and tables at the back of this report have been particularly devised for graphic comprehension of the complex screening processes used to identify likely and unlikely FEC siting areas.

2.1 CARTOGRAPHIC ANALYSIS

The cartographic technique, which culminated in a composite of the separate maps, was used in a series of preliminary screens to isolate areas unlikely to provide suitable FEC sites. Such areas (see Secs. 4.1-4.4) included public lands designated by legislation, Urbanized Areas (UAs), Air Quality Maintenance Areas (AQMAs), and areas where the attainment of TSP and SO_2 air quality standards would be jeopardized.

A map of counties with coal reserves was prepared from Bureau of Mines data available on a county-by-county basis; thus setting, with some exceptions for large counties, the spatial resolution used throughout the study. From this map and the composite preliminary map, a list of counties having coal reserves and most likely to provide FEC sites was prepared. The coal reserves available near these counties were then analyzed in detail.

2.2 COAL RESERVE ANALYSIS

Prior to analyzing coal availability in detail, the maximum sulfur content and minimum quantity, both corrected for heating value, required by twelve representative FECs were determined. These determinations assumed that the centers would meet national emission and ambient standards.* The area surrounding each county that passed the preliminary screens was then tested to ascertain the availability of adequate reserves having the required

---

*Coal with a lower sulfur content than indicated here would be required in states with standards more stringent than the national standards, as is the case in Wyoming, Arizona, and New Mexico and as being considered in Montana.

sulfur content. Areas that lacked reserves of sufficient quantity or quality were considered unlikely to provide FEC sites and were eliminated. Finally, maps were prepared of the remaining areas where coal supply and air quality limitations indicate that FEC sites are most likely.

2.3 POTENTIAL IMPACT OF PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

The impacts of PSD on potential FEC sites required an extension of both the analytic and cartographic techniques. Under PSD regulations, the air quality impacts of sources are required to be below certain defined levels, or increments of air pollution, that vary with the classification of the affected region. The coal reserve analysis described above is equivalent to assuming that the least restrictive or Class III PSD increment applies in the area impacted by the FEC. As a first step in the PSD analysis, a more restrictive, or Class II increment, was assumed to apply, and the same methodology was repeated for the smallest FEC considered (5000 Mwe), as indicative of the minimal potential impact of Class II designations.

The methodology employed to estimate the potential impact of the most restrictive, or Class I, designation depended upon the fact that these areas can exclude sources from places far beyond their borders. The small increment of air pollution allowed in Class I areas could be violated by a FEC miles away in an adjacent Class II or Class III area. This possibility of air pollution intrusion accounts for the far-reaching impact of Class I designations. To illustrate this impact, the likely siting areas found above assuming nationwide Class III designations were used as a base. The reduction in these likely siting areas resulting from implementation of the Class I areas in the Senate discussion draft of September 1975* was then estimated. These estimates were made by constructing a "buffer zone" about each Class I area, the width of which zone was estimated for a 5000-Mwe FEC and chosen to be sufficiently wide to keep the intrusion of polluted air from violating the increment. The excluded areas thus obtained were then used to limit the baseline Class III likely site areas. Since the large buffer zones required

---

*Current PSD proposals in both the House and Senate have substantially reduced the number of mandatory Class I areas below that specified in the September 1975 draft.

led to the exclusion of most of the promising site areas, a second smaller buffer zone was estimated assuming a 90% reduction in FEC emissions. The same methodology was then employed with the smaller buffer zone; and areas most likely to provide sites for 5000-Mwe FECs were determined, assuming flue gas desulfurization (FGD) in the 90-98%-efficiency range. These determinations are intended to be indications of potential effects and not definitive determinations of the effects of PSD regulations.

3. CHARACTERIZATION OF FECs

3.1 GENERAL CHARACTERISTICS

An energy center attempts to utilize the advantages accruing to the concentration of generating capacity in one location and the development of that capacity over time by replication of a small number of identical basic units. Knowing the emission characteristics and locations of the basic units in an FEC, its air quality impact can be estimated and used to determine the quality of coal necessary to meet air quality constraints. The quantity of coal necessary for the center depends upon the capacity and estimated lifetime.

The NSF Report 75-500 (Ref. 1), the principal authority for the discussion in this section, has already developed the characteristics of a large 26,240-Mwe FEC and estimated its air quality impacts. The center studied consisted of twenty-four units: eight each of 885, 1075, and 1320 Mwe. In estimating the air quality impacts, a center consisting of twenty-four identical 1320-Mwe units was considered, representing, within the accuracy of the models used, a balance between the reduced emissions and reduced plume rises associated with the smaller units. The baseline generating unit was characterized by:

- Rated capacity = 1320 Mwe,
- Heat rate = 8970 Btu/kwh,
- Stack height = 800 ft (244 m),
- Stack diameter = 37 ft (11.3 m),
- Exhaust velocity = 46.5 ft/sec (14.2 m/sec), and
- Exhaust temperature = 250°F (394°K).

The FEC actually modeled consisted of twelve unit pairs of these basic units with a separation of only 75-100 m between members of a unit pair so that they could be treated as a single source in the model. The report concluded that an optimum-sized FEC might be in the 2,000-20,000-Mwe range.

Given this result and our interim results for a 10,560-Mwe FEC,[3] the coal supply and air quality limitations were evaluated for FECs of 5-, 10-, and 20 x 10^3-Mwe capacities. This range extends from what might be considered the smallest "center," rather than a "plant," to the largest center that currently appear feasible. In addition, the effect of different unit locations within the center was assessed by considering two different configurations (described in Ref. 1): a basic, or compact, FEC and a spread-out FEC, shown in this report on Fig. 1.* A basic center contains the twelve unit pairs within 0.84 sq mi, whereas they occupy 36 sq mi in a spread-out center.

Reference 1 also concludes that the major air quality constraint on FECs is compliance with short-term SO_2 standards. Thus, assumptions concerning the efficiency of FGD are critical in characterizing FECs. Limitations are assessed herein assuming that no FGD is used and that FGD with 80%-removal efficiency will be available. SO_2 removal technology is presently in a state of development and the eventual availability of any particular degree of control cannot be determined. The 80% figure represents a technology that may reasonably be expected to be available within the time frame of FEC planning and construction.

In all, limitations were evaluated on twelve representative FECs having different combinations of the following characteristics:

Center capacity: 5,000, 10,000, 20,000 Mwe.
Configuration: Basic (compact), spread-out.
FGD efficiency: 0%, 80%.

3.2 COAL REQUIREMENTS

3.2.1 Air Quality Limitations

An FEC must meet two sets of standards related to air quality, New Source Performance Standards (NSPS) and National Ambient Air Quality Standards (NAAQS). Although some states have more stringent emission standards for new sources or more stringent ambient standards, the national standards were used to give a uniform comparison across the country. The NSPS are promulgated for various source categories by EPA and reflect the best system of emission reduction, which, considering costs, has been adequately demonstrated. These standards apply to new sources only and have been promulgated for fossil-fuel-

*Other configurations more optimal from the point of view of air quality impact probably exist. This report is based on the two configurations assumed in Ref. 1 as illustrative of the effects of various spacings of the individual units.

fired steam generators with more than 250 x 10^6 Btu/hr heat input. The basic units in a coal-fired FEC would exceed this minimum heat input and would be required to meet emission limits of:

1.2 lb $SO_2/10^6$ Btu heat input,
0.10 lb particulates/10^6 Btu heat input, and
0.70 lb $NO_2/10^6$ Btu heat input.

Other NSPS applying to opacity of emissions were not considered in Ref. 1, nor in this report.

Even when emissions satisfy NSPS, an FEC must not cause a violation of the NAAQS; compliance with both sets of standards is required. The NAAQS are given in Table 1 for those pollutants of which FECs are significant sources and both primary and secondary NAAQS must be met. The primary standards represent levels that protect human health; the secondary standards protect against welfare effects. Although the ambient standards do not directly limit emissions, an atmospheric dispersion model can be used to relate emissions to ambient air quality impact. The maximum allowable emissions would be those that cause an ambient concentrations equal to the NAAQS, Such a modeling effort is described in Ref. 1, and the results are scaled here to estimate the air quality impact of the representative FECs.

Once the maximum allowable emissions have been determined, the quality of coal required to meet these limits may be found. This quality depends upon the ratio of the sulfur content of the coal to its heating value. Since both these quantities vary widely among U.S. coals, the ratio was considered parametrically throughout the study and the critical value required for each representative FEC was determined separately.

3.2.2 Coal Quality and Quantity

For a 26,240-Mwe FEC meeting NSPS, Ref. 1 found the estimated maximum air quality impacts given on Table 2.[4] The meteorological conditions for the short-term SO_2 maximums are also given, and comparison of these values with the NAAQS in Table 1 shows that the 24-hour SO_2 standard is "controlling." That is, even if the stringent NSPS are met, the FEC by itself would still violate the ambient 24-hour SO_2 NAAQS by a greater factor than any other ambient standard. Thus, SO_2 emissions need to be reduced below NSPS levels to satisfy the ambient standard. Although even this large center would not by itself cause violations of the particulate or NO_2 NAAQS, the high 24-hour particulate maximum indicates that FECs should be considered major particulate sources. NO_2 should offer the least constraint, assuming that emissions are controlled to NSPS levels.

Since the 24-hour SO_2 standard is controlling, the coal available for the center must be of such a quality as to satisfy this constraint. In general,[5]

(lb SO_2 emitted/ton of coal fired) = 38 S,

where S is the percentage of sulfur in the coal (for a coal containing 2% sulfur, S = 2). If the heating value of the coal is H (in 10^3 Btu/lb), then a unit meeting NSPS must have

$$\begin{aligned}
(\text{lb } SO_2 \text{ emitted}/10^6 \text{ Btu}) &= 38\ S(\text{lb } SO_2 \text{ emitted/ton of coal fired}) \\
&\quad \times (1/2000)\ (\text{ton/lb}) \\
&\quad \times (1/H)\ (\text{lb of coal}/10^3 \text{ Btu}) \\
&= 1.2\ (\text{lb } SO_2/10^6 \text{ Btu})\ (\text{NSPS limit}) \\
\text{or, } (S/H) &= .0632 \text{ for NSPS.}
\end{aligned}$$

For example, for a coal with 12,000 Btu/lb (H = 12), the sulfur content must be 0.76% (= .0632 x 12) or less to meet NSPS.* This S/H ratio can be reduced as required for compliance with ambient standards, scaled for different capacities, and increased to reflect increases in flue gas desulfurization efficiency. Using a rollback approach for the basic center which causes a maximum concentration of 1442 μg/m^3 (see Table 2), a reduction in coal sulfur content by 365/1442 is required to meet the SO_2 NAAQS. For a center with one half the capacity, coal with twice the sulfur content could be fired without changing the ambient impact, since only half as much coal is required by the smaller center. This scaling by capacity assumes that a small center would consist

---

*The sulfur contents of coals calculated here exceed those of Ref. 1 by about 5%. The use of the emission factor 38 S assumes that some of the sulfur in the coal is carried out in the boiler bottom ash. This small effect was not included in Ref. 1 and their procedure is equivalent to using an emission factor of 40 S. It should also be noted that Ref. 1 assumes that a 24-hour SO_2 standard of 260 μg/m^3 must be met. This standard has been rescinded at the federal level while the 365 μg/m^3 standard upon which this study is based continues in effect.

of the same number of units as a large center with each unit having a smaller capacity and retaining otherwise identical characteristics, such as plume rise and stack height, that affect plume dispersion. The scope of this study precluded a more detailed modeling analysis showing how a choice of parameters, perhaps more appropriate to the smaller FECs, would affect the air quality impact. The effect of FGD efficiency is somewhat more difficult to explain. FGD is usually discussed in terms of the fraction η of SO_2 removed from flue gases (called the "efficiency" when expressed as a percentage). However, when assessing the ambient impact, the fraction of SO_2 escaping to the atmosphere is the quantity of interest. This throughput fraction is $(1-\eta)$. If two centers have the same capacity and the first has an FGD system allowing an SO_2 throughput one-fifth that of the second, then the first center can utilize coal with five times the sulfur content of the second and still have the same ambient impact. Combining these three factors and expressing the results mathematically:

$$(S/H)_{Basic} = .0632 \times (365/1442) \times (26240/C) \times (1/(1-\eta))$$
$$= 420/C(1-\eta) \quad (\%/10^3 \text{ Btu/lb}),$$

where C = capacity of FEC (Mwe).

Similarly, for the spread-out center,

$$(S/H)_{Spread\text{-}out} = .0632 \times (365/614) \times (26240/C) \times (1/(1-\eta))$$
$$= 986/C(1-\eta) \quad (\%/10^3 \text{ Btu/lb}).$$

These results determine the maximum S/H ratio (or minimum quality) that a coal can have and still be an acceptable fuel for FECs. Since the NSPS must be satisfied simultaneously, the maximum allowable value of S/H is 0.0632. These results are presented graphically on Fig. 2 for both configurations with no FGD ($\eta = 0$) and with 80%-efficient FGD ($\eta = 0.80$). It should be noted that other assumptions on the efficiency of FGD would lead to different allowable S/H ratios. For example, had 90%-efficient FGD been assumed, coals with twice the S/H ratios with 80%-efficient FGD would have been usable in the controlled representative FECs. Table 3 gives the minimum coal quality that would allow each of the twelve representative FECs to comply with both the SO_2 NAAQS and NSPS. Coals with S/H ratios less than the tabulated values could be fired. For the representative centers, these results show that both configurations of 5000-Mwe center and the spread-out 10,000-Mwe center would meet the ambient limits if their emissions were to comply with NSPS. Reduction of emissions below the NSPS level would be necessary for the other representative centers to meet the 24-hour SO_2 NAAQS.

The quantity of coal required by an FEC is independent of the configuration and FGD efficiency if the capacity figures are assumed to be nameplate ratings. As in Ref. 1, the center was assumed to have a 75%-capacity factor and a unit lifetime of 35 yr. A 26,240-Mwe FEC with these characteristics was found to consume 177,000 T of coal per day with a heating value of 12,000 Btu/lb.[6] A center one-half this size would need only one-half this amount of coal, or 88,500 T/da. If the coal had a heating value of only 6,000 Btu/lb, twice as many tons per day would be required. Expressing these two proportions in equation form and changing units,

$$\begin{aligned}\text{Quantity of required reserves} &= (177{,}000)\ (\text{T/day}) \\ &\times (365)\ (\text{day/yr}) \\ &\times (35)\ (\text{yr}) \\ &\times (C/26240) \\ &\times (12/H) \times 10^{-6} \\ &= 1.034(C/H)\ (10^6\ \text{T}).\end{aligned}$$

The required reserves for the three representative capacities are listed on Table 3 for a typical Eastern coal of 12,000 Btu/lb, a premium quality coal of 11,500 Btu/lb, and a low heating value Western coal of 8,000 Btu/lb.

4. PRELIMINARY SCREENS

Once the air quality impacts and coal requirements of FECs were determined, the screens were conducted. Preliminary screens, independent of the magnitude of the expected air quality impacts and coal requirements, were run first. These screens eliminated areas where suitable sites for large SO_2 and particulate emitters are unlikely based on indicators of potential or measured air quality problems and areas from which FECs are excluded by legislation.

4.1 NATIONAL PUBLIC LANDS

The legislation regulating the siting of energy centers has been interpreted by the Nuclear Regulatory Commission as precluding the siting of FECs in National Parks, National Forests, National Monuments, and National Wilderness Areas. Figure 3 indicates the approximate extent of each of these four types of national public lands.[7] Since the other screens were limited in spatial resolution to areas the size of counties, the outlines of the national public lands were drawn as idealized shapes rather than precise geographic representations. Small enclaves within the boundaries of a park and narrow strips of land between the several parcels of a park or between two different parks were excluded from consideration as likely FEC sites.

4.2 URBANIZED AREAS

Due to the pollution generated by the activities associated with high population densities, cities are generally areas with high potential or actual air pollution. In particular, urbanized areas might reasonably be expected to experience elevated levels of particulates or SO_2. Thus despite the fact that urban areas are prime users of electric power, air quality considerations suggest that a major air pollution source like an FEC not be located close to an urban area.

The U.S. Bureau of the Census[8] has published a series of maps of urbanized areas in the United States. An urbanized area (UA) is defined as a central city or twin cities, with a population of 50,000 or more, and the surrounding closely settled territory.[9] To screen urbanized areas, the Bureau of the Census maps were examined and those counties that contained parts of urbanized areas were placed on a list of counties considered unlikely to provide an acceptable site for an FEC. This list was modified in some cases to include counties that did not contain parts of a defined urbanized area but were within 3-4 mi of the central city of a defined area. In other cases, counties having only a very small portion of an urbanized area were excluded from the list. Figure 4 presents smoothed outlines of the counties on this list. The areas within these outlines are unlikely to provide suitable sites for FECs. In the case of large counties (greater than about 2500 sq mi), only that portion of the county within a radius of 30 mi of the central city was included within the area screened as unacceptable. This procedure refined the gross spatial resolution resulting from screening out an entire large county because of an urbanized area covering only a fraction of the county and helped to keep the spatial resolution relatively uniform across the entire country.

Detailed site-specific evaluation might indicate that an FEC could be sited even within the regions screened out on the basis of Urbanized Areas. However, the expected probability of finding an acceptable site in an Urbanized Area is low due to the air pollution problems generally associated with them.

4.3 AIR QUALITY MAINTENANCE AREAS

The federal Clean Air Act requires that states develop and implement State Implementation Plans to attain and maintain the National Ambient Air Quality Standards. As part of its mandate under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has designated as Air Quality Maintenance Areas (AQMAs) those places having either present problems in attaining the NAAQS or expected problems in maintaining them due to projected growth or development. In areas designated for particulates, sulfur dioxide, and possibly nitrogen dioxide, acceptable sites for FECs would probably be very difficult to locate. Hence, such AQMAs were screened out.

Figure 5 shows the approximate boundaries of the areas designated as AQMAs for TSP and SO_2. (All AQMAs for NO_2 are included within AQMAs for either TSP or SO_2.) These areas generally follow county boundaries.[10] In some instances, only cities or portions of a county are included in the designated AQMA. For counties under about 2500 sq mi the entire county was screened out if any portion of it is part of an AQMA. For six larger counties, an estimate of the extent of the AQMA was made, based on the location of cities where TSP and SO_2 problems might be expected.

Although no major changes are expected, an intensive analysis of the designated AQMAs is being conducted by the EPA, which may result in changes in the AQMA boundaries. Pending further study, some AQMAs in Montana, North Dakota, Wyoming, Colorado, and Utah, indicated by special shading on Fig. 5, have been designated on the basis of expected energy-related development due to available energy resources. As such, they were not excluded as likely FEC sites, although they would require more detailed air quality analyses.

4.4 MEASURED AIR QUALITY

The screens based on measured concentrations were conducted by comparing measured air quality in a county with the most stringent applicable ambient air quality standards. The screens were run for TSP and SO_2 only, since there are very few places having NO_2 air quality data and since FECs may not be a primary source of NO_2. The screens were based on the summary data for the three years 1972-1974 stored in EPA's Storage and Retrieval of Aerometric Data (SAROAD) system. A county was considered unlikely to provide a suitable site if the SAROAD data indicated a potential violation of any applicable state or federal ambient air quality standard. In making this assessment for a county, a conservative approach was adopted. If data from more than one site in a county was recorded in SAROAD, the most polluted site was used to screen the entire county. When data was available from more than one of the three years, the most recent year of data was used.

Understanding that the standard of comparison used in the screen was not uniform across the nation is important. The NAAQS (see Table 1) apply where states have either no standards or less-stringent standards. States can, however, have ambient standards that are more stringent than NAAQS. These standards were used in the screens where they apply and the states are listed on Table 4.[11,12] For example, the annual secondary TSP standard of 60 μg/m^3 has been designated as a guide at the federal level but has been retained by several states. In these states, 60 rather than 75 was used in the screen on annual average TSP air quality. Some states also have 1 hour SO_2 standards and these were included in the screen.

Since the summary SAROAD data contains only annual average information, estimates of 24-, 3-, and 1-hour concentrations had to be made for comparison with the appropriate standards. These estimates were made using Larsen's methods.[13] However, comparison with ambient standards of estimates made by Larsen's methods is not a valid means for determining whether the standards are being violated, for which process only actual measured data may be used. In the air quality screens, an estimate that exceeded the most stringent applicable standard was interpreted to mean that the county was unlikely to provide a site for an FEC. Comparison with the standards was accurate for the annual averages because these averages were based on measured data. When there were indications of violations of the applicable standards for any averaging time, a county was screened out. Larsen's methods should not be used in locations dominated by single large point sources. The SAROAD data provides no way of determining which data records came from such areas. However, even in these situations, Larsen's methods retain a validity sufficient to show the probable existence of air quality problems.

Figures 6 and 7, respectively, show the results of the TSP and SO_2 air quality screens. In the case of counties with areas greater than 5000 sq mi, the area indicating a probable air quality problem was located as a city when the information in SAROAD permitted such an identification, and a portion of the county within forty miles of that city, rather than the entire county, was screened out. A smoothing process on the regions with probable air quality problems was then used to produce Figs. 6 and 7.

In addition, these figures show those areas for which data was available but for which there were no indications of air quality problems. Where data was not available, there was no reason to exclude the county as a potentially acceptable site. Therefore, the unshaded areas of the two figures cannot be eliminated as areas likely to provide FEC sites.

4.5 COMPOSITE PRELIMINARY SCREEN

On Fig. 8, the areas unlikely to provide suitable FEC sites, based on the preliminary screens for national public lands, Urbanized Areas, AQMAs, TSP air quality, and SO_2 air quality, have been combined cartographically. Of these, only the first where FECs are excluded by legislation can be considered an absolute screen. The others provide indicators of where location of a suitable site would be extremely difficult. The AQMAs in the West designated on the basis of expected energy-related development were not included in the areas screened out on Fig. 8. Thus, the unshaded areas on Fig. 8 show regions where air quality considerations indicate the best chance of locating an FEC without considering coal availability or the precise magnitude of the center's air quality impact. These unshaded areas should not be interpreted as suitable sites, but rather as areas where, given the limitations based on air quality, additional screens could be used to show where site-specific studies have the best chance of locating suitable sites. One such additional screen, coal availability, is described in Sec. 5. Other screens could include considerations such as water availability, which might prove a potential limitation in the arid West, terrain, and proximity to load centers. In those areas lacking air quality data (see Figs. 6 and 7), such additional screening would have to include the collection and interpretation of representative air quality data.

4.6 SUMMARY AND CONCLUSIONS

Cartographic screens were applied to areas from which FECs are excluded by legislation and areas where suitable sites for large particulate and SO_2 emitters are unlikely. The categories screened were:

National public lands,
Urbanized Areas,
Air Quality Maintenance Areas,
Measured TSP air quality, and
Measured SO_2 air quality.

Several main conclusions were reached after the preliminary screens:

1. The TSP air quality screen alone could account for the majority of the areas screened out.

2. Although particulate emissions could be reduced below NSPS levels by use of more efficient controls (98.7% removal was assumed in Ref. 1), the fugitive emissions resulting from center operations such as coal handling had not been included in the modeling impacts. Hence, increased particulate removal from the flue gases might not reduce the exclusionary impact of poor particulate air quality.

3. Very few areas were screened out solely on the basis of poor existing SO_2 air quality or location in a specified national public land.

4. Compliance with the 24-hour SO_2 ambient standard would require reduction of emissions from large FECs to below NSPS levels. A large FEC would need to reduce emissions below NSPS levels to meet the ambient constraint before it could be built anywhere. A center built to meet NSPS is limited in size by the ambient constraint.

5. Even without considering the magnitude of a center's air quality impact or the availability of coal, a substantial portion of the nation appears unlikely to provide suitable FEC sites because of the areas from which FECs are excluded by legislation, proximity to major urbanized areas, and existing or potential high levels of particulates or sulfur dioxide.

5. ANALYSIS OF COAL RESERVES

5.1 COAL AVAILABILITY

Coal reserve data[14] was available for each county in the coterminous United States. For many counties, the reserves had been analyzed for sulfur content (S) and heating value (H). Total reserves with an S/H ratio less than or equal to that required by the representative FECs were determined, based on these analyses. Unanalyzed reserves were proportioned according to the reserve distribution in the state as given on Table 5. For each county with reserves, Table 6 shows the total coal reserves with various minimum qualities as measured by the ratio of sulfur content to heating value.

In view of the high costs associated with hauling coal over long distances, only counties with reserves were screened for FEC sites. Consideration was limited to mine-mouth or near mine-mouth centers utilizing coal from the site and neighboring counties. Figure 9 displays the counties containing coal reserves, but for large counties in the West, the spatial resolution of the map was improved by including only that portion of the county actually containing coal as shown by a map of United States coal fields.[15]

Coal bearing counties were eliminated from further consideration if they had failed to pass the preliminary screens. Table 7 lists these counties and the screens they failed to pass. It was determined by combining the coal reserve map and Fig. 8. Counties excluded as being in national public lands are not included on the table. In some cases as, for example, where a National Park boundary divided a county, a judgment was required as to whether to screen out the entire county. The decision generally adopted was that if more than 50% of the county was included in the excluded area, the whole county was screened out. The coal reaserves of the remaining counties were subjected to a detailed analysis, and counties with reserves that passed the preliminary screens are listed on Table 8. Reserves in counties that were screened out by the preliminary screens, however, were still considered available for use by FECs in neighboring counties.

5.2 SCREENS FOR FEC REQUIREMENTS

The detailed analysis of reserves was carried out in two steps for each of the twelve representative FECs. First, a county not already screened out (from Table 8) was roughly evaluated for its suitability as a mine-mouth site. Rough screens were conducted on quantity and quality. To pass these rough screens (and hence remain under consideration as a siting area), a county had to have at least 10% of the required quantity of coal, independent of sulfur content and to have at least some reserves of the required quality, independent of quantity. Counties not satisfying both these minimal requirements were considered unlikely to provide suitable sites and were eliminated.

The rough screen on quantity was conducted conservatively by assuming a high heating value of 14,500 Btu/lb for all coal, and the values used were ten percent of the requirements listed on Table 5. The rough screen on quality compared the requirements on Table 5 with the available reserves on Table 6. If any reserves existed with the required or better quality, the county was not screened out.

When conducted in this fashion, the rough screen could lead to anomalies. For example, a county could fail to pass the rough quantity screen but be surrounded by large high-quality reserves. However, the continuity of the final results and several spot checks of potentially anomalous situations indicated that the rough screen did not seriously affect the general conclusions and did save a significant amount of time in screening coal reserves.

Second, for counties passing the rough screen, locally available reserves were analyzed in detail. In the East, the local area was taken to be the county itself plus contiguous counties. Where very small counties were concerned, non-contiguous counties were included within the local area. Generally, the local area included those counties within 50-60 mi of the county being screened. In the West, contiguous counties were included in the local area if one-third or more of their coal reserve area fell within 50-60 mi of the center of the county being screened. Limiting available reserves to those close to the site county accords with preset utility siting practice. Where coal is available, about 60% of proposed fossil sites are within 50 mi of the fuel supply.[16] The total locally available reserves of various qualities were then determined, based on the data on Table 6. For a county to pass this detailed screen, the local area had to have an adequate reserve base of the quality required by the FEC.

The screen thus eliminates areas with large reserves that have too high a sulfur content to satisfy air quality constraints. Using the S/H ratio to measure quality automatically corrected for both sulfur content and heating value. The quantity of reserves was adjusted by the statewide average heating values given on Table 5. Examination of the county-by-county coal data showed that any error introduced by using this method of determining the quantity was small compared to the more precise method of correction using local heating values. The counties that passed these screens for each of the twelve representative FECs are listed on Table 9 and mapped on Figs. 10-14, inclusive. The shaded areas on the maps show the regions most likely to provide suitable sites for FECs of a given capacity and configuration, with no FGD and with 80%-efficient FGD. Since the S/H ratio required with no FGD is 20% of that required with 80% FGD, any area that is likely to provide a site for an FEC without FGD is also likely to provide a site for an FEC with 80% FGD. Due to the smoothing process used in making the maps, the indicated areas do not follow county boundaries precisely. The same is true, of course, of the likely site areas and the differences are well within the accuracy imposed by the county-sized limit on spatial resolution. In general, the areas indicated are those to which other screens such as water availability might efficaciously be applied prior to undertaking site-specific studies. They are <u>not</u> necessarily areas where FEC sites exist; they <u>are</u> areas where considerations of air quality and coal availability indicate that FEC sites are most likely.

Some idea of the relative difficulty of siting FECs can also be gained by comparing the total number of counties likely to provide suitable sites. These totals are given for each state on Table 10 and must be used with some circumspection, as the number of counties reflects only approximately the areas involved. However, comparison of either the maps or the totals clearly shows that as the capacity of the center increases, the likely site area diminishes. The advantage of the spread-out configuration and the significant increase in areas likely to provide suitable sites when FGD is used are also shown.

Several limitations were inherent in this analysis. Consideration was limited to mine-mouth FECs utilizing local coals. In determining the required coal quality, the effects of local terrain on the center's air quality impact were not considered. Finally, no assessment was made of cleaning or blending local coals to achieve the required quality.

5.3 SUMMARY AND CONCLUSIONS

The local coal reserves of counties passing the preliminary screens were analyzed for quantity and quality. Areas were determined in which there are sufficient quality reserves for FECs and from which FECs are not excluded by legislation or indicators of poor air quality.

In determining these areas, several conclusions regarding suitable siting areas were reached:

1. There are apparently no such siting areas for a large (20,000-Mwe) basic FEC without flue gas desulfurization. A limited area might provide suitable sites for a large spread-out FEC without FGD.

2. Use of the spread-out rather than the basic (compact) configuration increases the area most likely to provide them.

3. Areas might be found for an FEC as large as 10,000 Mwe without reducing emissions below NSPS levels, provided a spread-out configuration was used.

4. The area most likely to provide such sites is very sensitive to the assumed FGD efficiency. Certain areas in Illinois, Indiana, Ohio and Kentucky would pass the screens if higher efficiencies, say 90%, were assumed, thus allowing utilization of coals with twice the S/H ratio allowed under the 80%-efficient FGD assumption used here.

6. POTENTIAL IMPACT OF PSD

6.1 INTRODUCTION[17]

In 1972, the Sierra Club and other environmental groups sued EPA in federal court for failure to promulgate regulations for the prevention of the significant deterioration of air quality as required under the Clean Air Act. The court ordered EPA to promulgate such regulations, which were published in December 1974.[18] Later, as part of the Energy Independence Act of 1975, Congress was requested to clarify congressional intent toward PSD. At present, there are proposals in the Senate and House* similar to EPA's promulgated regulations but having different potential impacts on FEC siting.

In all three alternative approaches, significant deterioration is to be prevented by establishing ambient air quality concentration increments that may not be exceeded by major new sources. Rather than specify maximum concentration limits as in the NAAQS, the PSD alternatives take existing air quality as a base and limit the additional amount, or increment, of pollution. Each plan also establishes classes of areas to which different increments would apply. EPA's regulation establishes three classes:

- Class I - Areas that are to be kept pristine and in which almost any deterioration would be considered significant;
- Class II - Areas where the deterioration normally accompanying moderate, well-controlled growth would not be considered significant; and
- Class III - Areas where deterioration up to the secondary NAAQS would be permitted.

Table 11 gives the alternative increments. In addition to the constraints imposed by NAAQS and NSPS, an FEC's air quality impact could not exceed the applicable increment. Comparison of these increments with the NAAQS and the FEC air quality impacts shows that the analysis just completed would apply if

---

*The Senate discussion draft as of September 8, 1975, and the House discussion draft as of June 16, 1974, including Congressman Heinz's amendments of September 4, 1975,[19] were used as the basis for this work. The actual bills as of August, 1976, include substantial changes from these earlier drafts, particularly in reducing the number of mandatory Class I areas.

the EPA Class III increments were implemented nationwide and that the 24-hour increment is controlling under all alternatives.

The situation is unsettled; EPA has designated the entire nation Class II and the congressional proposals would mandate certain national public lands Class I. While the eventual requirements for PSD are uncertain, several scenarios can be used to illustrate the range of potential impacts.

6.2 SCENARIOS

Two different scenarios were examined:

1. Implementing of the EPA/Senate Class II increment nationwide, and
2. Designating the areas proposed in the Senate discussion draft of September, 1975, as mandatory Class I and requiring the FEC to meet NSPS.

The first scenario can be made to reflect the PSD regulation now in effect by using the EPA/Senate 24-hour SO_2 increment of 100 $\mu g/m^3$. The potential impact of the House Class II increment is approximated, although it is 9% less than the EPA/Senate increment.

The second scenario estimates the minimal impact from mandatory Class I areas proposed in the discussion drafts. The Senate proposal has fewer mandatory areas than the House proposal (see Ref. 20) and additional areas could be designated Class I. This scenario shows the significant impact that Class I designations could have on FEC siting. (It should be noted that the final Senate bill of March, 1976 has reduced the number of mandatory Class I areas below the number specified in the discussion drafts.

Effects of these scenarios were estimated only for the 5000-Mwe FECs, the size least constrained by coal availability and most likely to pass additional screens based on factors not considered here. Since any area screened out as unlikely to provide a 5000-Mwe FEC site would be inappropriate for the larger centers as well, the limitation implies that the minimal impacts of the scenarios are being illustrated.

6.3 IMPACT OF EPA/SENATE CLASS II INCREMENT

Under the first scenario, the maximum allowable 24-hour SO_2 impact of an FEC is 100 $\mu g/m^3$. In the previous analysis, likely site areas were determined assuming that the maximum impact was 365 $\mu g/m^3$. The same procedures can be used with changes being made at the appropriate places to reflect the increased stringency of PSD regulation. In particular, the methodology of Sec. 3.2.2 can be used to estimate the required S/H ratios. Figure 15 and Table 12 give the coal quality required to meet the Class II increment and are analogous to Fig. 2 and Table 3. Note that all of the representative centers must reduce emissions below NSPS level in order to meet the 100 $\mu g/m^3$ limit. Using the new coal quality requirements of Table 12, an analysis like that of Secs. 4 and 5 locates the most likely site counties listed on Table 9. These counties were mapped to show the areas most likely to provide suitable FEC sites on Figs. 16 and 17. Constraint by an ambient rather than an emission limit produces a difference between the likely site areas for the two different configurations. These figures may be compared to Fig. 10 to determine the reduction in likely siting area resulting from Class II implementation. The totals on Table 10 present the same information numerically. Differences between either the mapped areas or the totals indicate that the impact of requiring the Class II rather than the Class III increment to be met could be large, especially for the basic center.

6.4 IMPACT OF SENATE MANDATORY CLASS I DESIGNATIONS

The Senate mandatory Class I areas proposed in the discussion draft are shown on Fig. 18.[21] They cover only a fraction of the nation and a different analysis methodology is required to estimate their impact. The analysis determines the distance at which an FEC could cause a violation of the Class I increment and then constructs a "buffer zone" of that width around the mandated areas. Areas within the buffer zones probably would be unsuitable as FEC sites and can be used to further screen the likely site areas identified in the initial analysis.

To determine the size of the buffer zone, an extension of the results of Ref. 1 was necessary. Both configurations of 5000-MWe FECs were modeled using EPA's PTMTP dispersion model and meteorological conditions representative of long-range transport:

Mixing height - 1000 m,
Wind speed - 11 mph, and
Stability Class C.

In addition to the dispersion of contaminants, the effect of SO_2 deposition was included in the model. Under conditions of uniform mixing, the deposition of SO_2 can be approximated by reducing the concentration predicted by a Gaussian dispersion model like PTMTP by a factor $\exp(-x/\xi)$, where x is the downwind distance from the source and ξ is a constant, depending on wind speed, mixing height, and the dry deposition velocity. A dry deposition velocity of 1 cm/sec was assumed giving ξ = 261 mi for the assumed meteorological conditions.

Figure 19 graphs the maximum 24-hour SO_2 concentration versus distance for a 5000-MWe basic FEC. Only the basic center was modeled, since both configurations had identical impacts within the accuracy of the model at distances beyond 60 miles. Based on this figure, the EPA/Senate Class I increment of 5 $\mu g/m^3$ would be violated out to 250 mi. A buffer zone of this size around the Senate mandatory Class I areas specified in the discussion draft would exclude FECs from the entire nation. However, PTMTP is not generally considered valid for distance greater than about 60 miles. As a reasonable compromise between the limitations of the model and Fig. 19, a 100-mile buffer zone was chosen. This estimate was also consistent with estimates of Ref. 17, which, by graphical extrapolation, gave about 1 or 2 $\mu g/m^3$ at 100 miles from a 1000-MWe power plant.[2-]

The regions excluded as FEC sites with 100-mile buffer zones around Senate mandatory Class I areas are shaded on Fig. 20. These results were combined cartographically with Fig. 10 to produce Fig. 21, which presents areas most likely to provide suitable sites for a 5000-MWe FEC that uses local coals, complies with NSPS and NAAQS in the immediate vicinity, and is sufficiently removed from mandated areas to meet the Class I PSD increment. The great reduction in site areas due to Class I designations is clear from a comparison of Figs. 10 and 21 and from the reduction in the number of counties likely to provide sites, as shown on Table 10.

Because the imposition of the 100-mi buffer zones caused such a great reduction in likely siting area, the effect of increasing FGD efficiency to reduce buffer-zone size was investigated. With increased FGD efficiency, less SO_2 is emitted and the air quality impact of the center is reduced; the distance at which the Class I increment is violated is similarly reduced. For illustrative purposes, an emission reduction of 90% was assumed. Under this assumption, centers would emit SO_2 at only 10% of the rate allowed by the NSPS. The required FGD efficiencies would be 90 and 98%, respectively, in those areas of Fig. 10 where no FGD and 80%-efficient FGD had been assumed previously.

The analysis proceeded just as in the previous case. The dashed line on Fig. 19 shows the maximum 24-hour SO_2 impact when emissions (and hence ambient concentrations) are reduced by 90%. The buffer zone would be about 40 miles wide. PTMTP predicted some difference in the air quality impacts between the two configurations at this distance, but the results for the basic center were used for both as a conservative approximation well within the accuracy of the model. The areas excluded by the 40-mile buffer zones are presented on Fig. 22 and the result of combining this figure with Fig. 10 appears on Fig. 23. Some care must be exercised in interpreting this figure. Had the entire analysis been predicated upon assumptions of 90%- and 98%-efficient FGD, lower quality coals and hence a larger set of likely site areas would have been found prior to imposition of the Class I PSD scenario. Thus, a greater area than shown would be likely to provide suitable sites if such SO_2 removal technology were available. Figure 23 does indicate the degree of control required in the original likely site areas if the Senate mandatory Class I provision were implemented. Either comparison of Figs. 21 and 23 or the results on Table 10 show that the likely siting area is greater with the 40-mile buffer zones than with the 100-mile buffer zone, reinforcing the earlier conclusion that assumptions about FGD efficiencies are critical in screening for likely site areas.

6.5 SUMMARY AND CONCLUSIONS

The potential impacts of the alternative approaches to PSD were illustrated by looking at the restriction in likely site areas for 5000-Mwe FECs under two scenarios. In the first, a maximum 24-hour SO_2 impact, less than the NAAQS, was assumed. In the second, the effect of designating certain national public lands as pristine areas was assessed. Since the second scenario practically eliminated likely site areas, the effect of reducing emissions to 10% of NSPS levels was estimated.

This analysis resulted in several main conclusions about the potential impacts of PSD:

1. The implementation of PSD regulations may well be the limiting factor in FEC siting decisions.

2. Redesignation of an area from Class I or II to Class III increases the potential for siting an FEC in or near that area.

3. Implementation of the set of mandatory Class I areas proposed in the Senate discussion draft could in effect preclude siting even a 5000-Mwe FEC. The current (July 1976) Senate and House proposals contain fewer mandatory Class I areas than were considered in this report.

4. Flue gas desulfurization with 90-98% efficiency could substantially reduce the impact of the Class I designations. The technological feasibilit and reliability of FGD systems with efficiencies greater than 90% is present y open to question.

5. Implementation of alternative Class II limits would require FECs to reduce emissions to below NSPS levels.

6. The likelihood of finding an FEC site in a Class II area is small for centers of more than 10,000-Mwe capacity.

7. Designation as a Class II area would not preclude the siting of FECs in the 5,000 to 10,000-Mwe range, but would require the use of flue gas desulfurization.

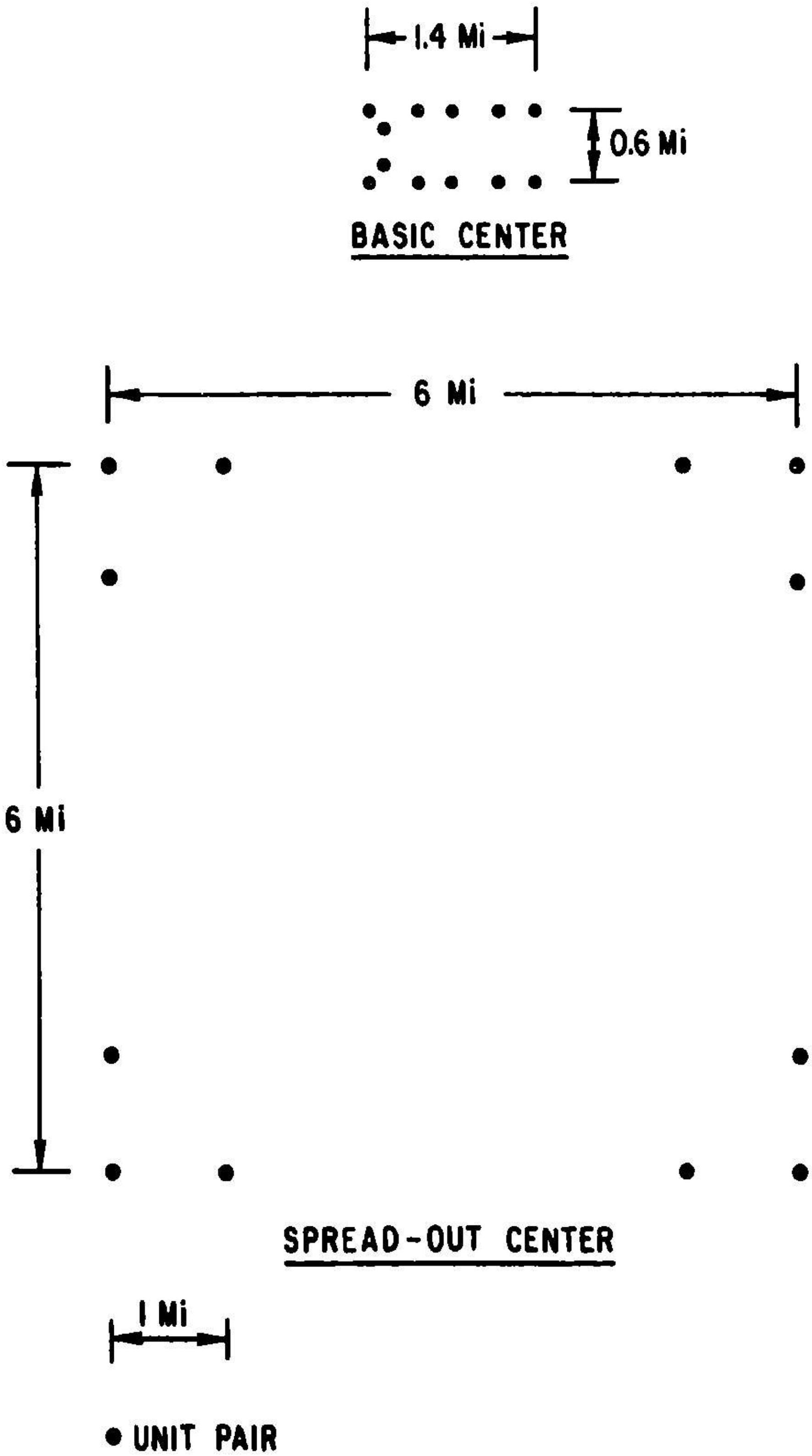


Fig. 1. Fossil Energy Center Configurations
(Source: Ref. 1, p. 1/2-163)

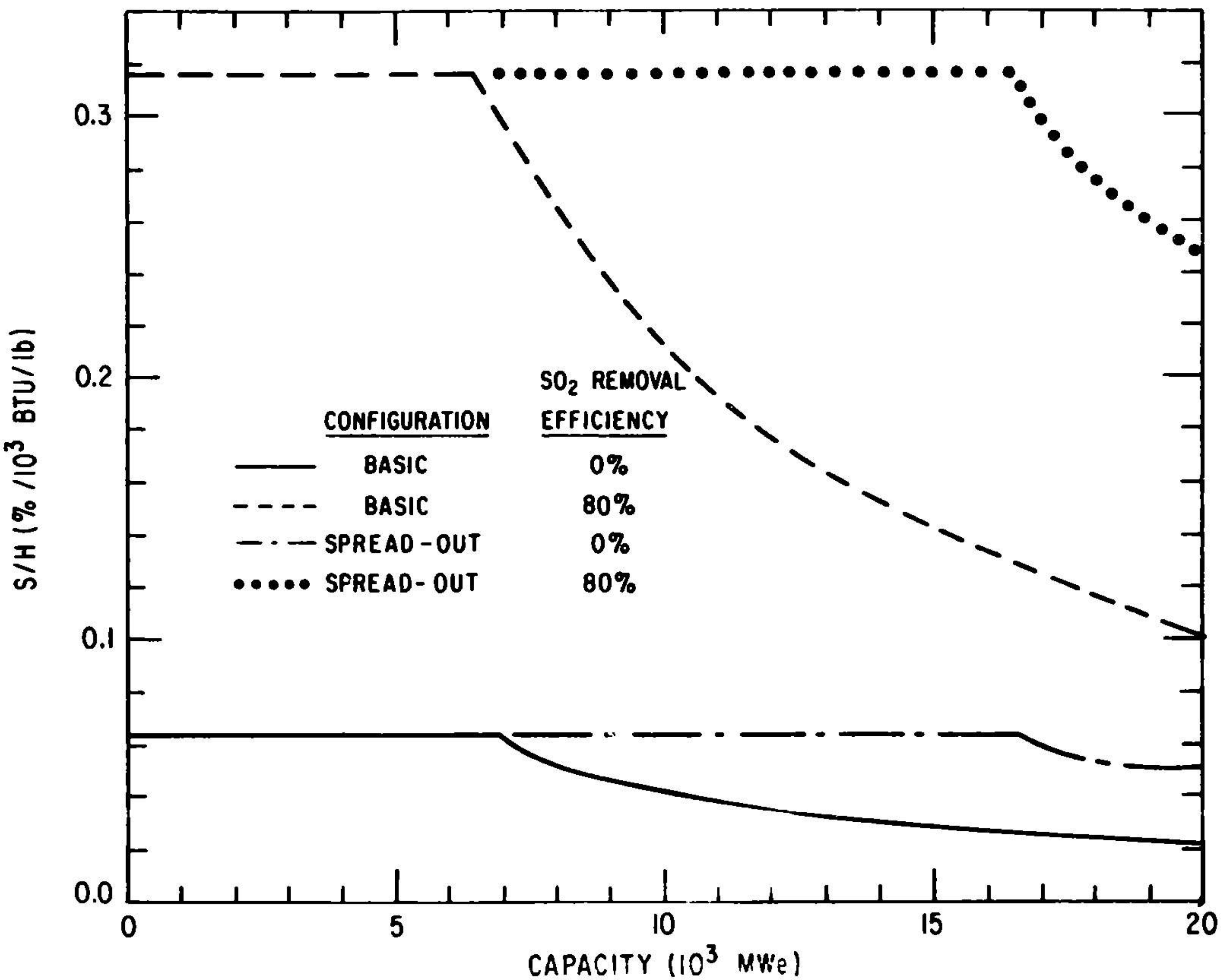


Fig. 2. Sulfur Content to Heating Value Ratio for EECs Complying with NSPS and NAAQS

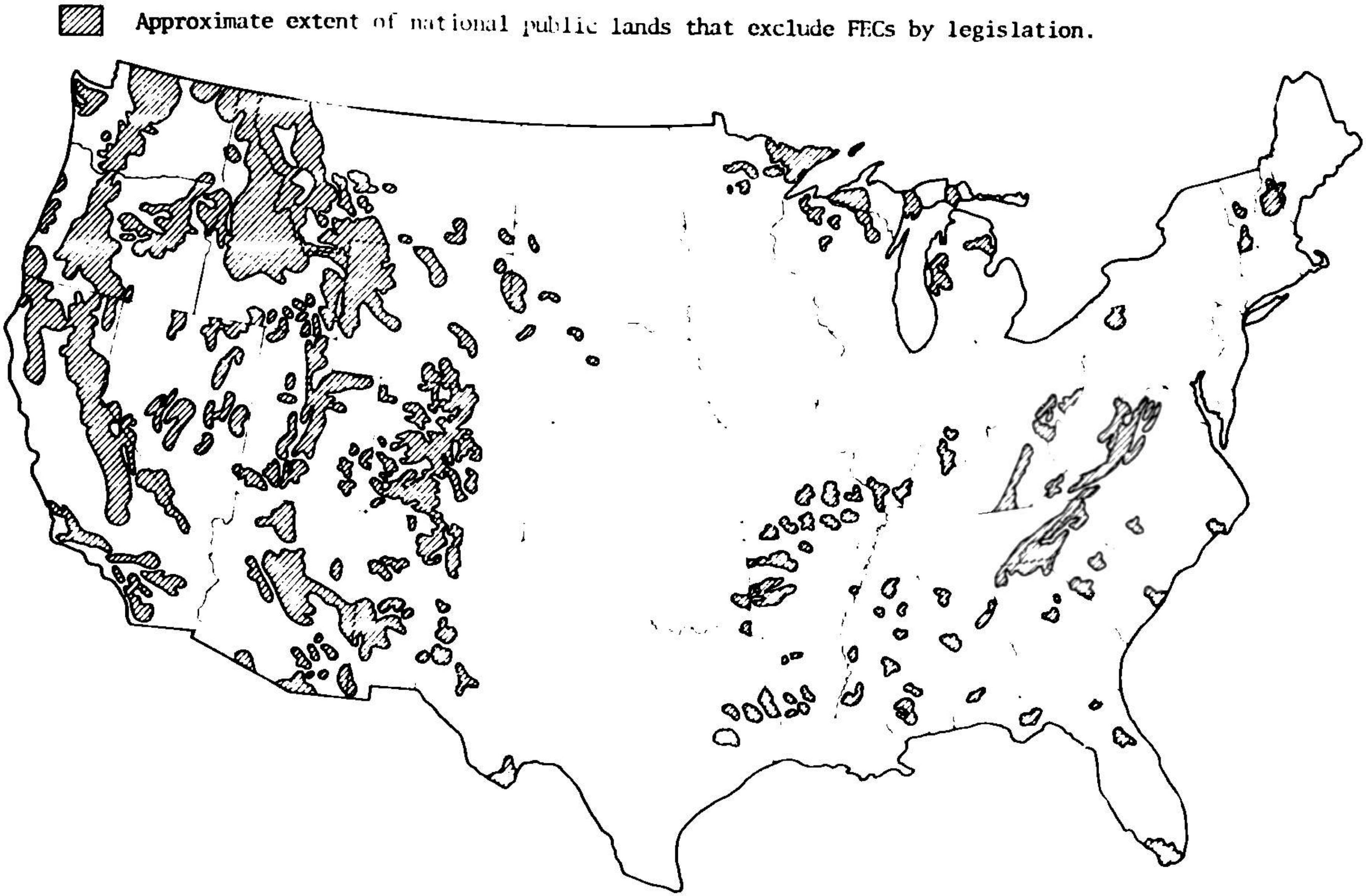


Fig. 3. Screen for National Public Lands

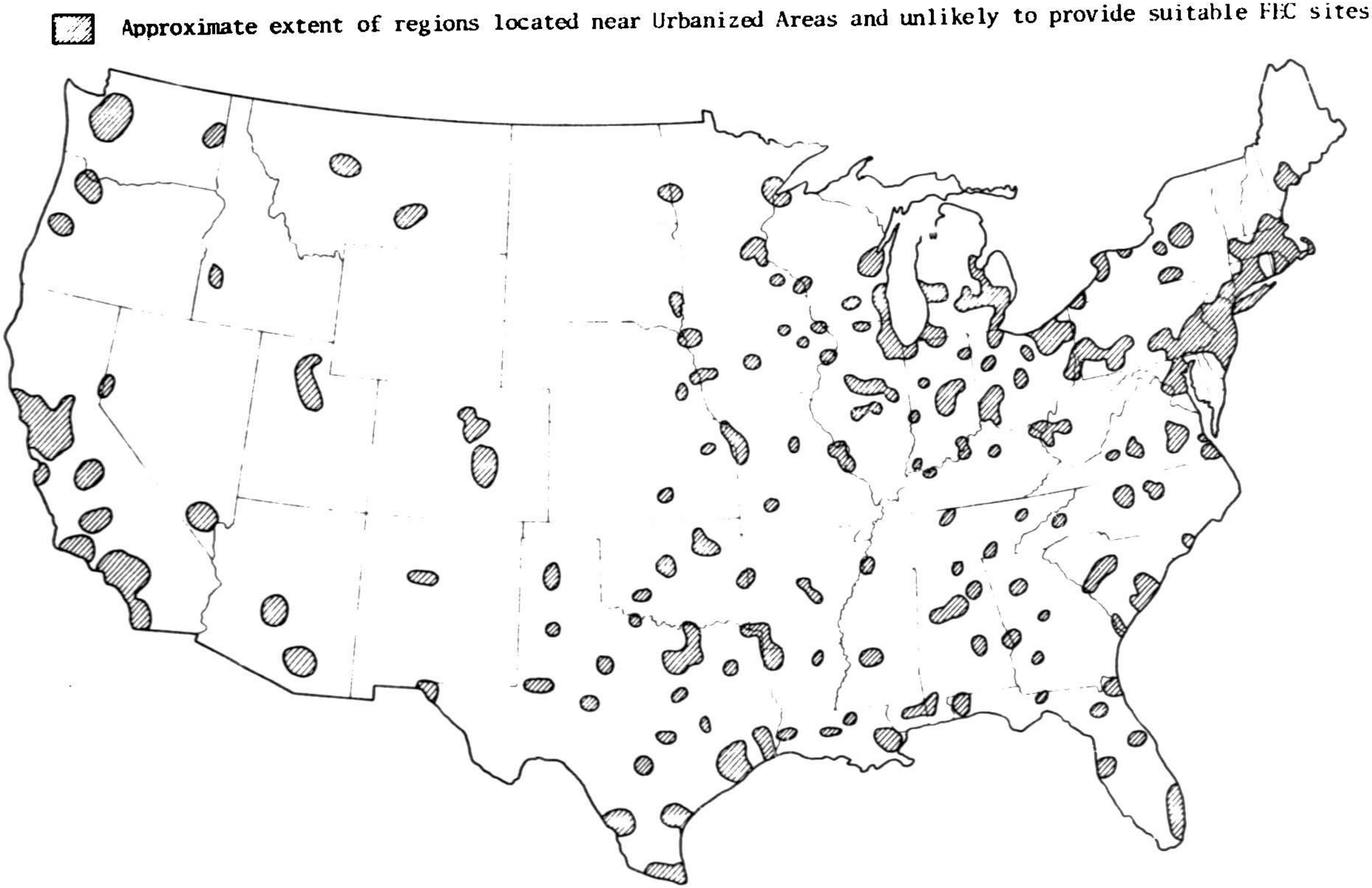


Fig. 4. Screen for Urbanized Areas (UAs)

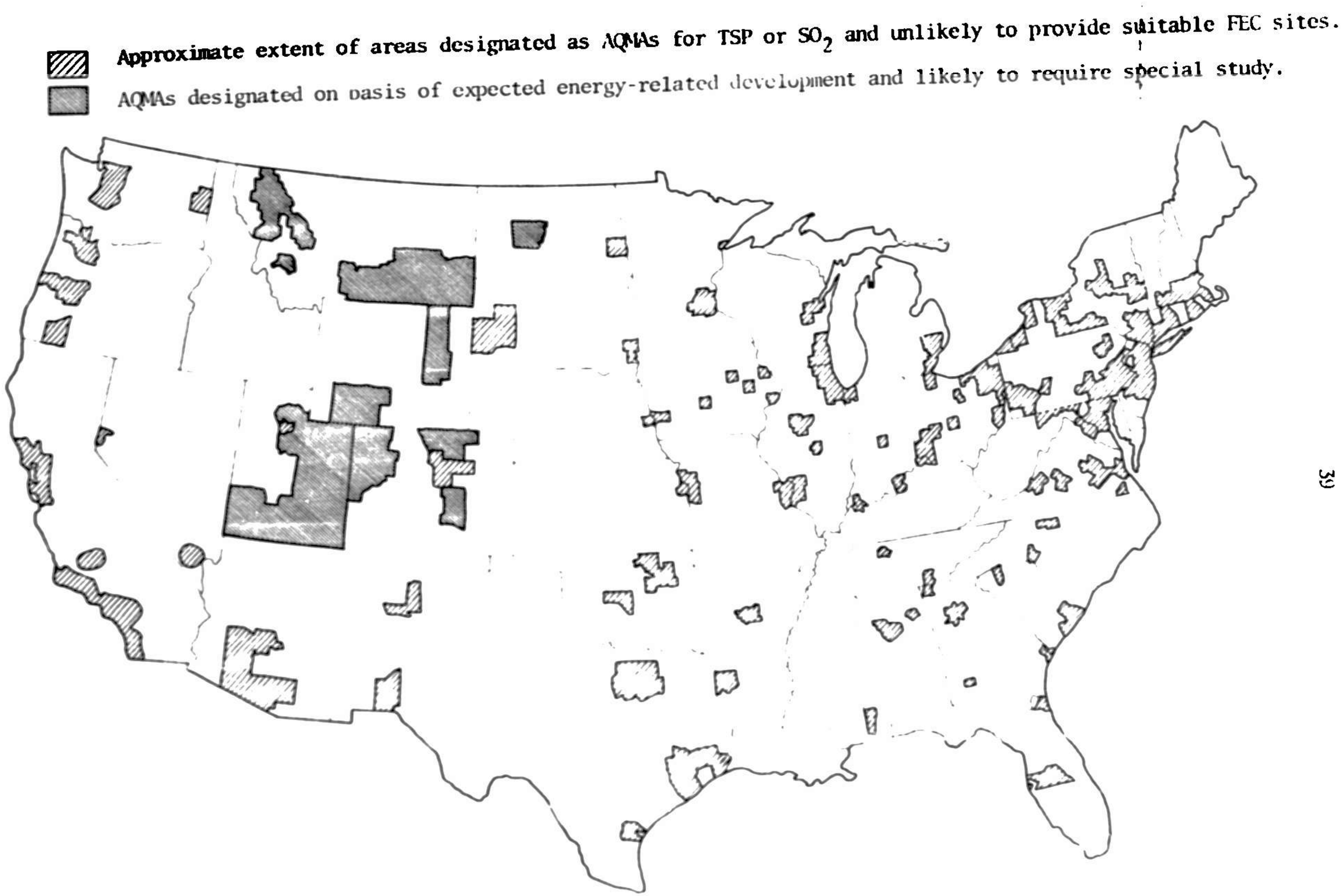


Fig. 5. Screen for Air Quality Maintenance Areas (AQMAs)

Areas where SAROAD data indicates poor particulate air quality and where suitable FEC sites are unlikely.

Areas where SAROAD data indicates acceptable air quality.

Areas with no available TSP data in SAROAD.

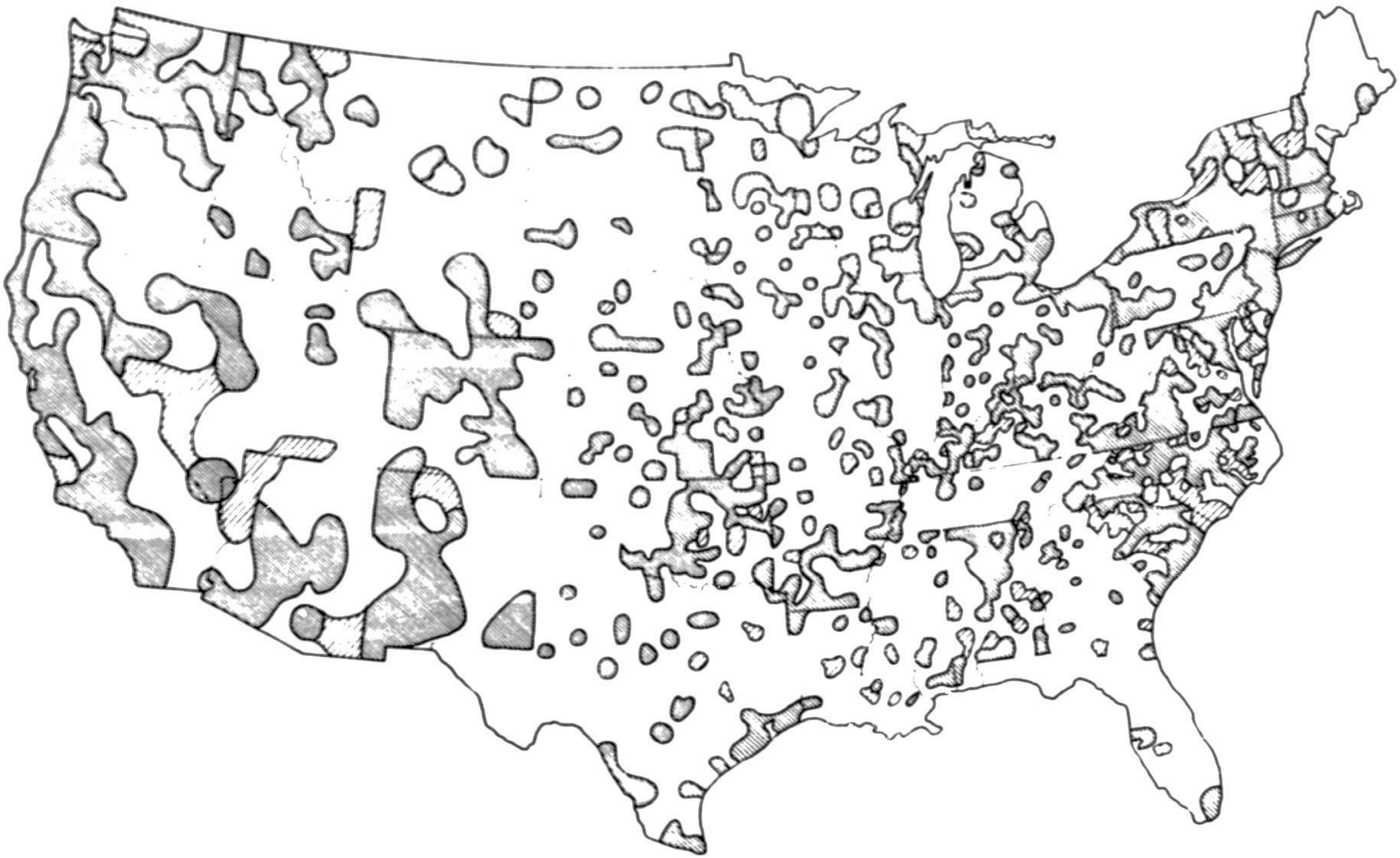


Fig. 6. Screen for TSP Air Quality

Areas where SAROAD data indicates poor SO_2 air quality and where suitable FEC sites are unlikely.
Areas where SAROAD data indicates SO_2 air quality is acceptable.
Areas with no available SO_2 data in SAROAD.

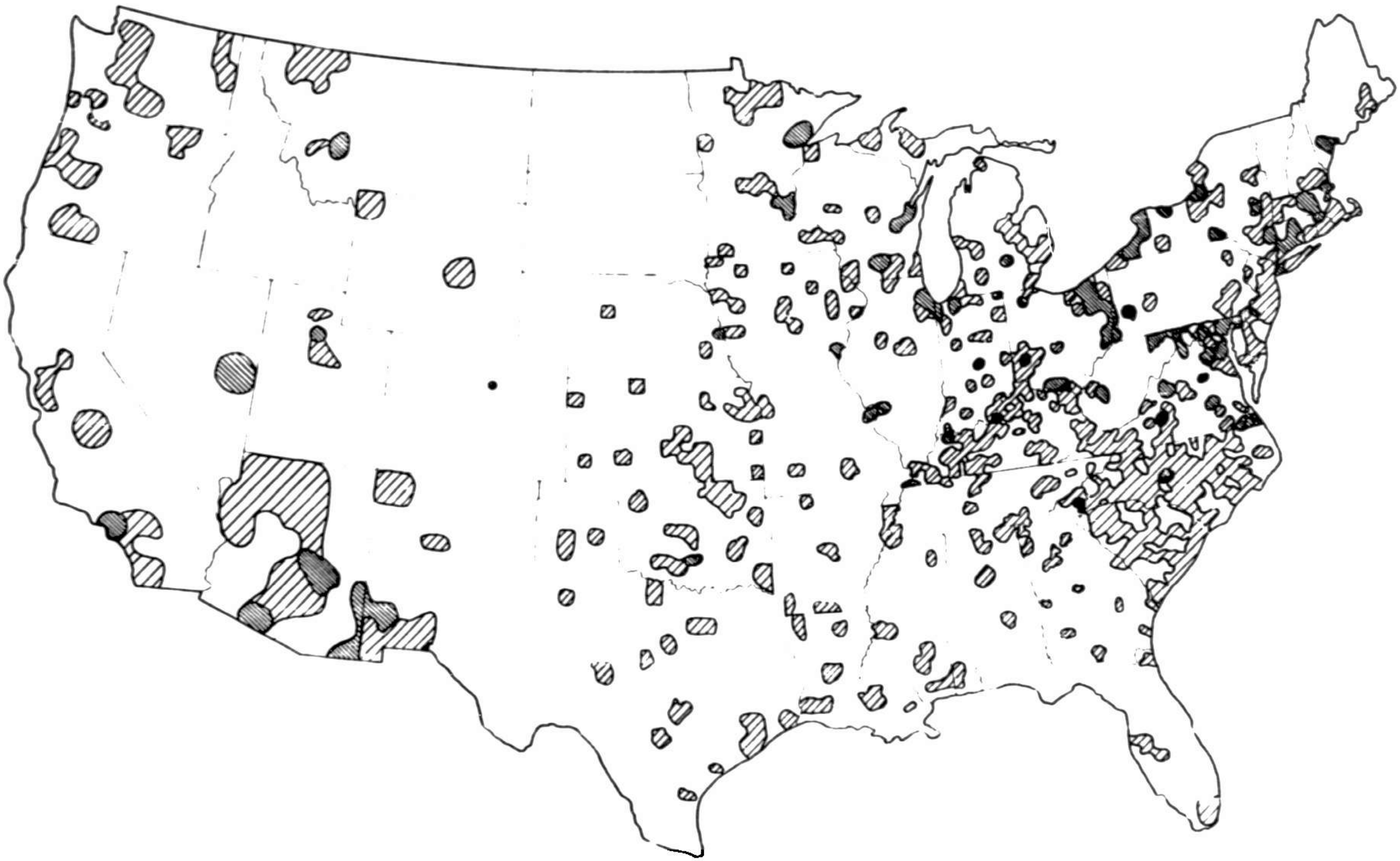


Fig. 7. Screen for SO_2 Air Quality

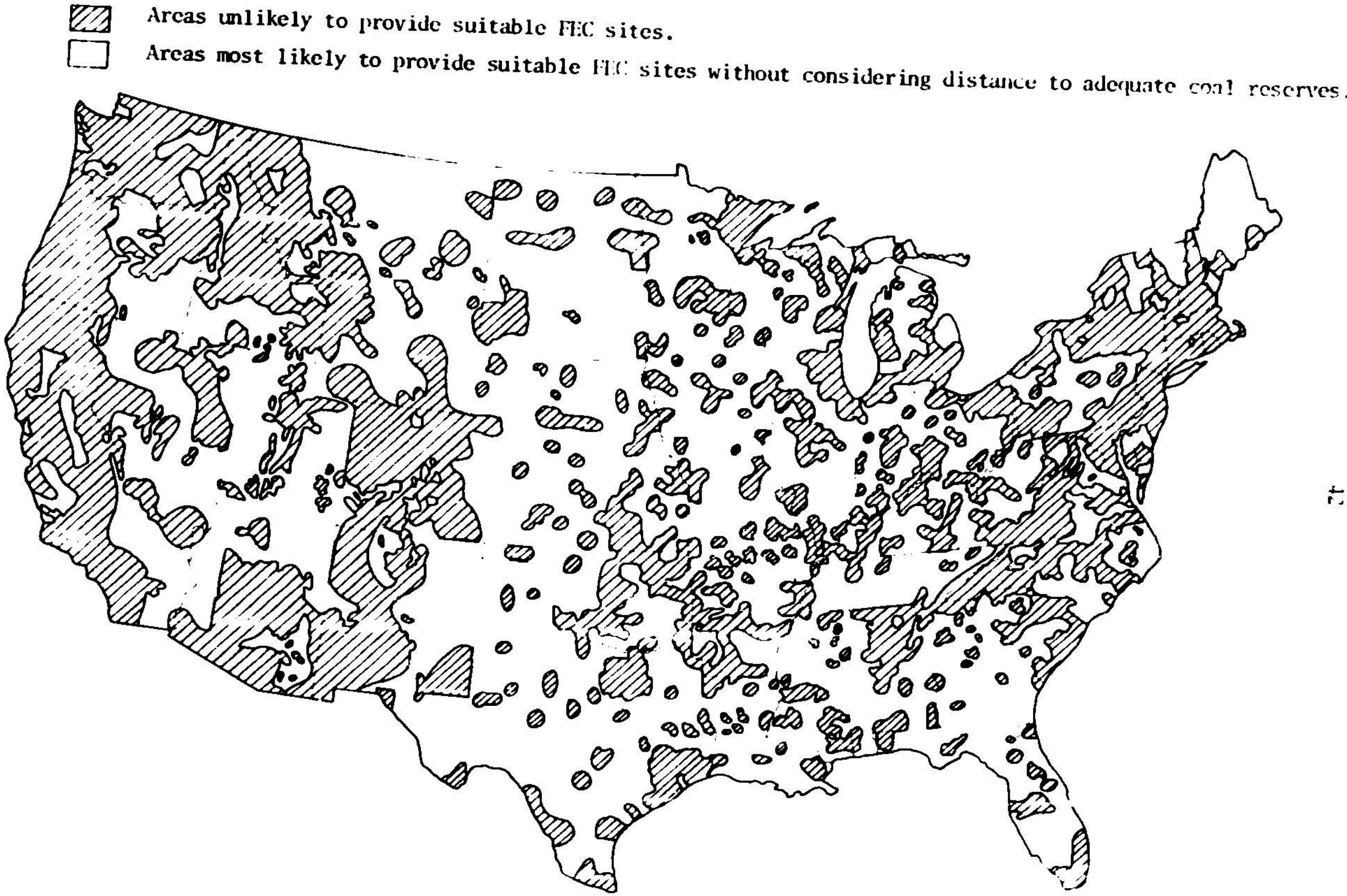


Fig. 8. Composite Screen without Considering Coal Reserves

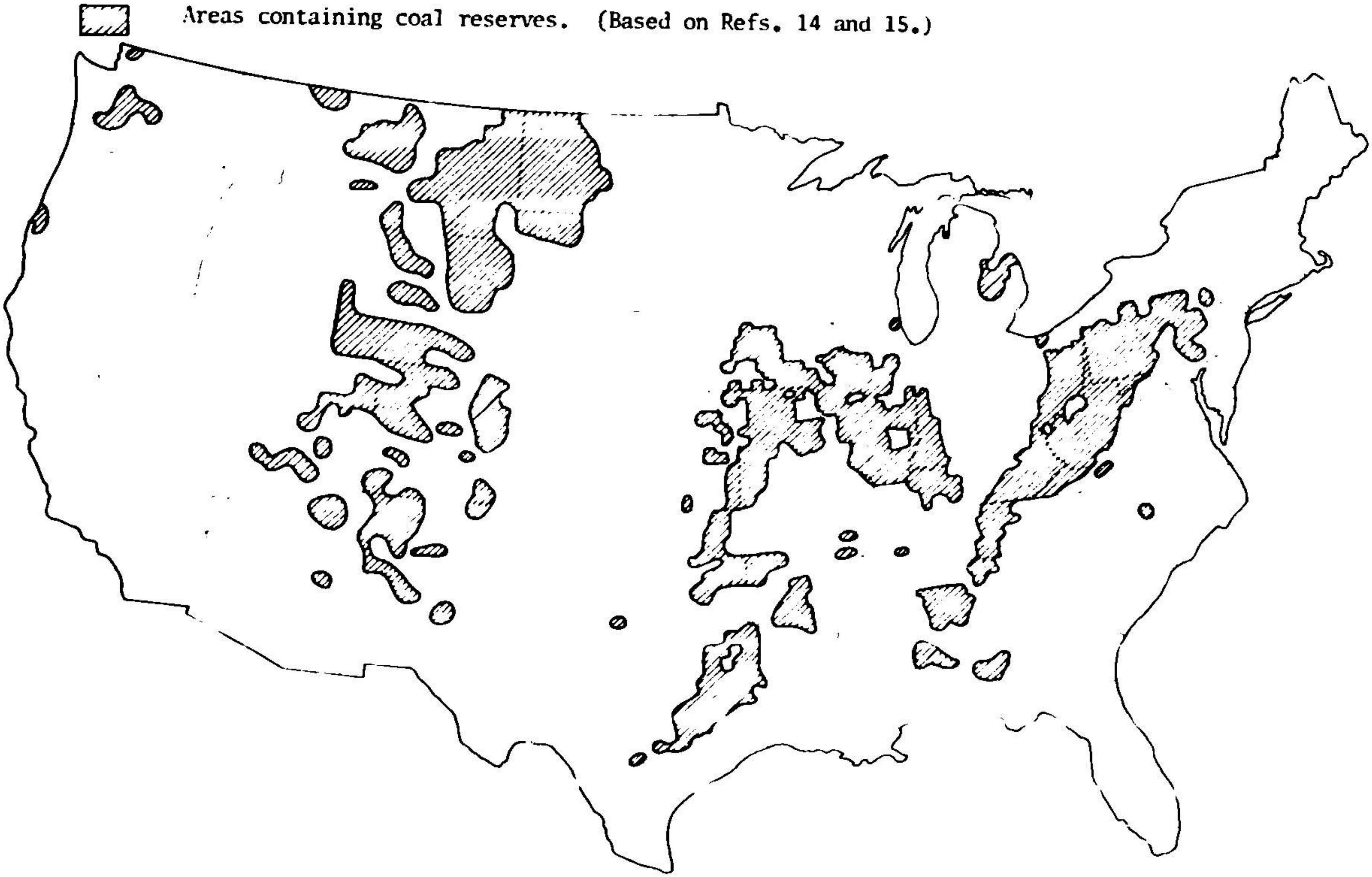


Fig. 9. Screen for Coal Reserves

Fig. 10. Areas Most Likely to Provide Suitable Sites for
5000-Mwe FECs Complying with NSPS and NAAQS

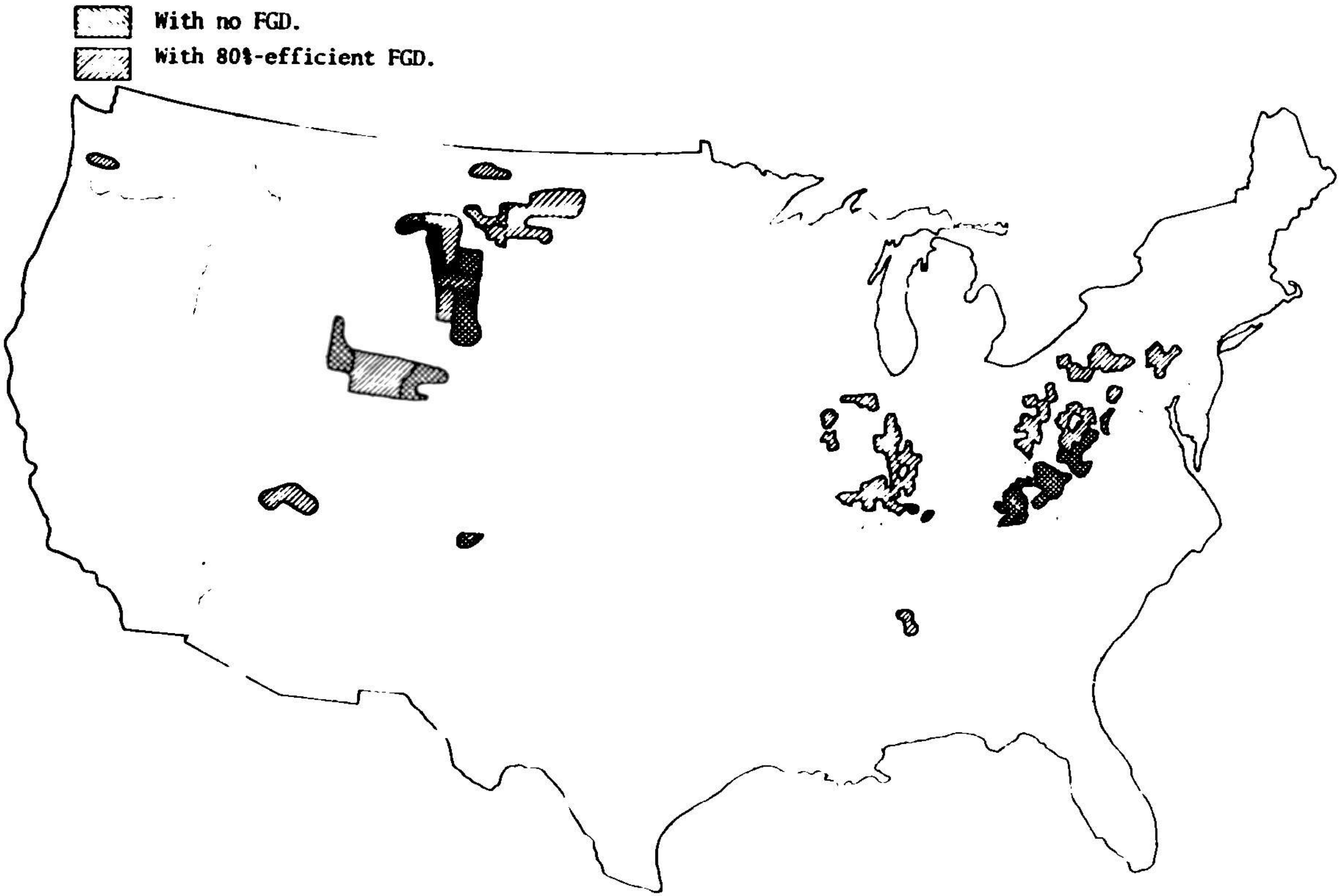


Fig. 11. Areas Most Likely to Provide Suitable Sites for 10,000-Mwe Spread-out FECs Complying with NSPS and NAAQS

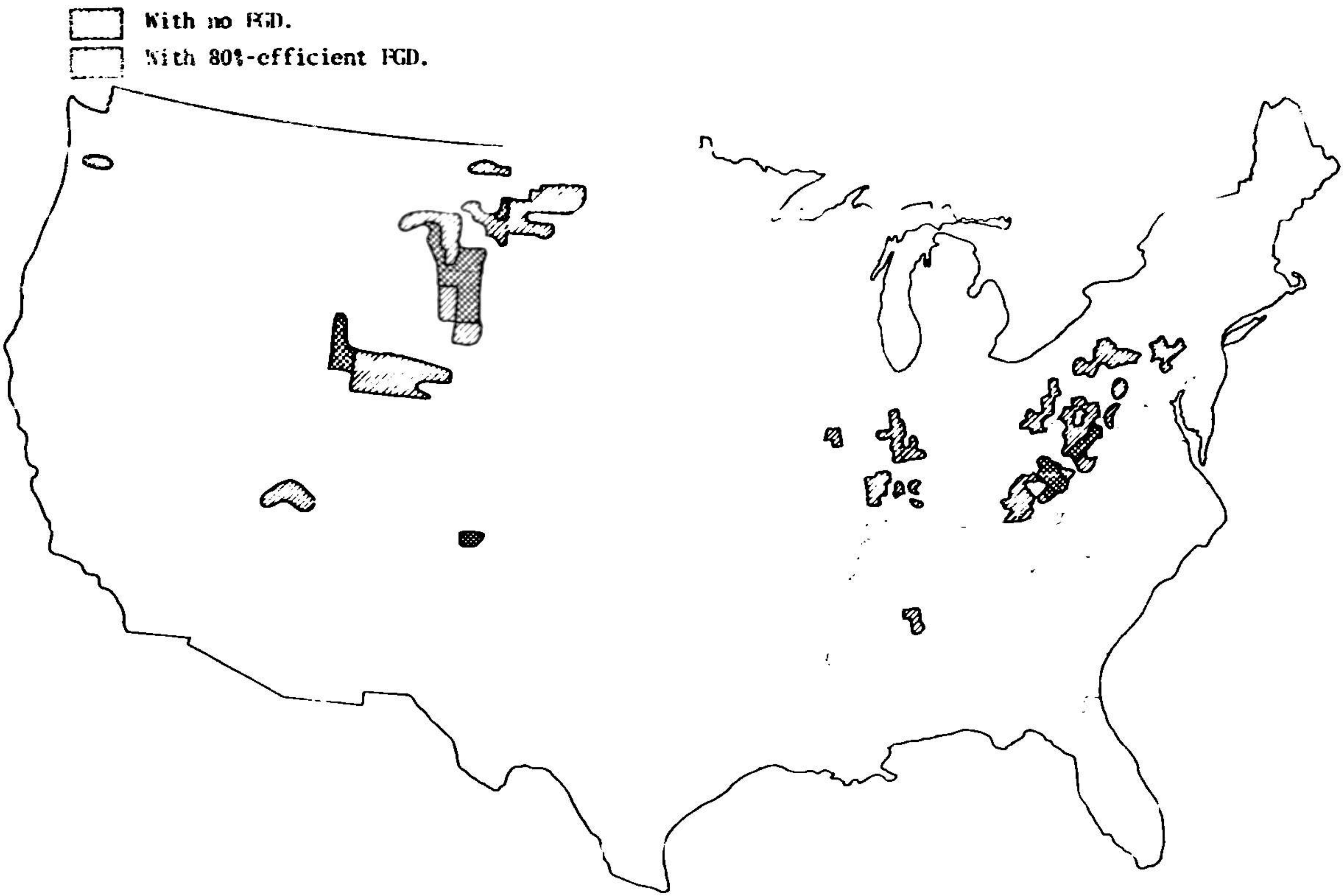


Fig. 12. Areas Most Likely to Provide Suitable Sites for 10,000-Mwe Basic FECs Complying with NSPS and NAAQS

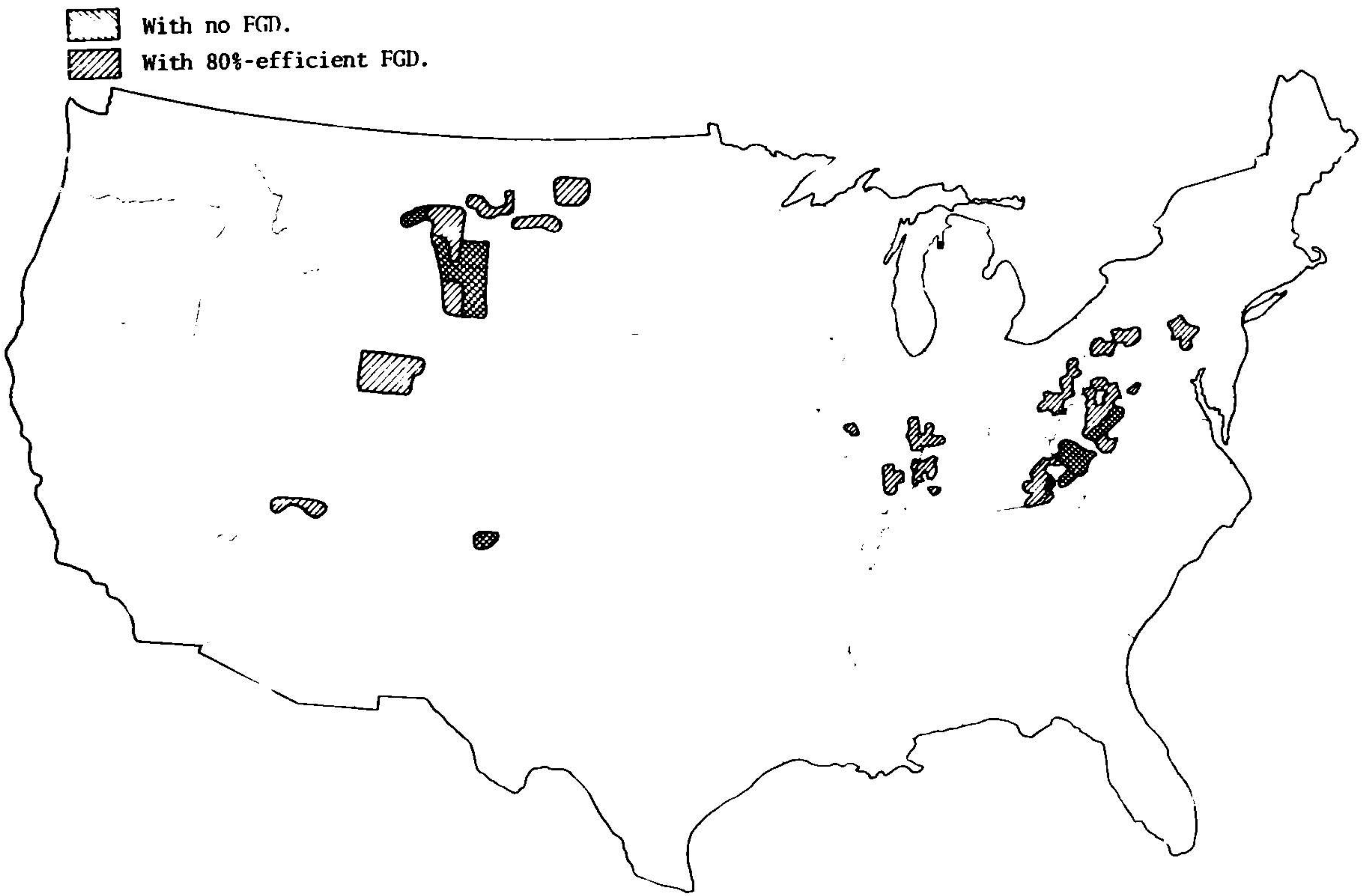


Fig. 13. Areas Most Likely to Provide Suitable Sites for 20,000-Mwe Spread-out FECs Complying with NSPS and NAAQS

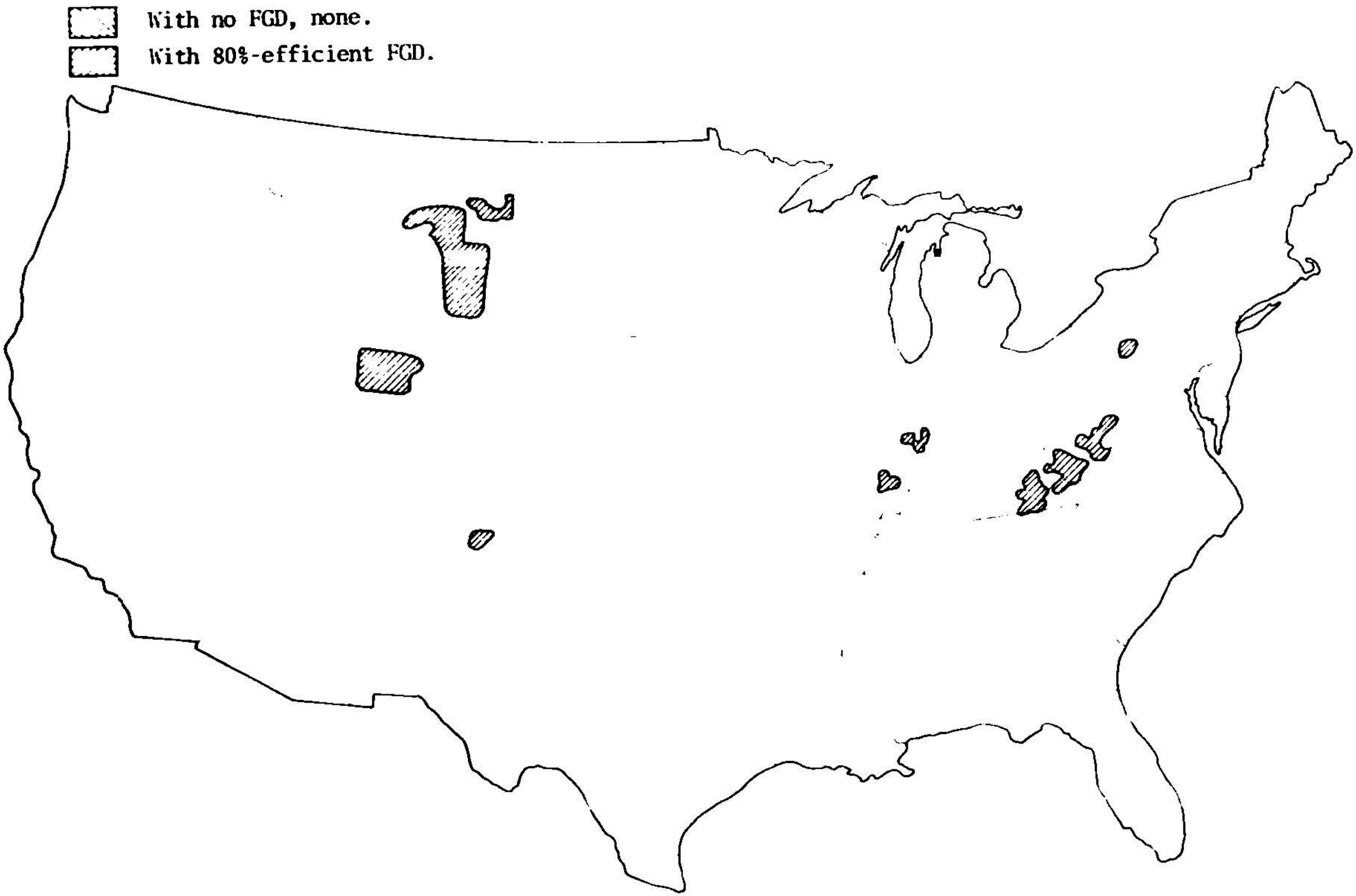


Fig. 14. Areas Most Likely to Provide Suitable Sites for 20,000-Mwe Basic FECs Complying with NSPS and NAAQS

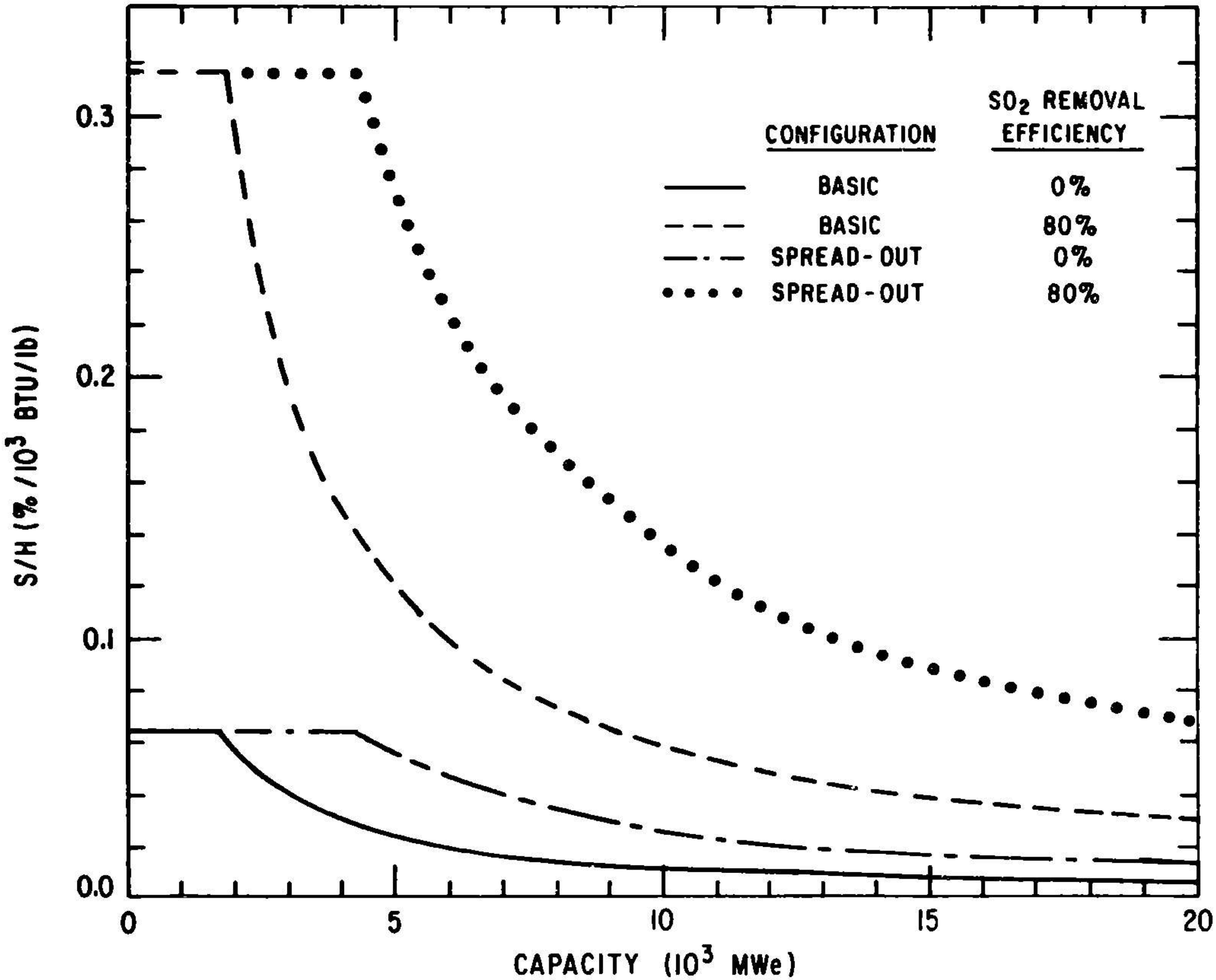


Fig. 15. Sulfur Content to Heating Value Ratio for FECs Complying with NSPS and EPA/Senate Class II Increment

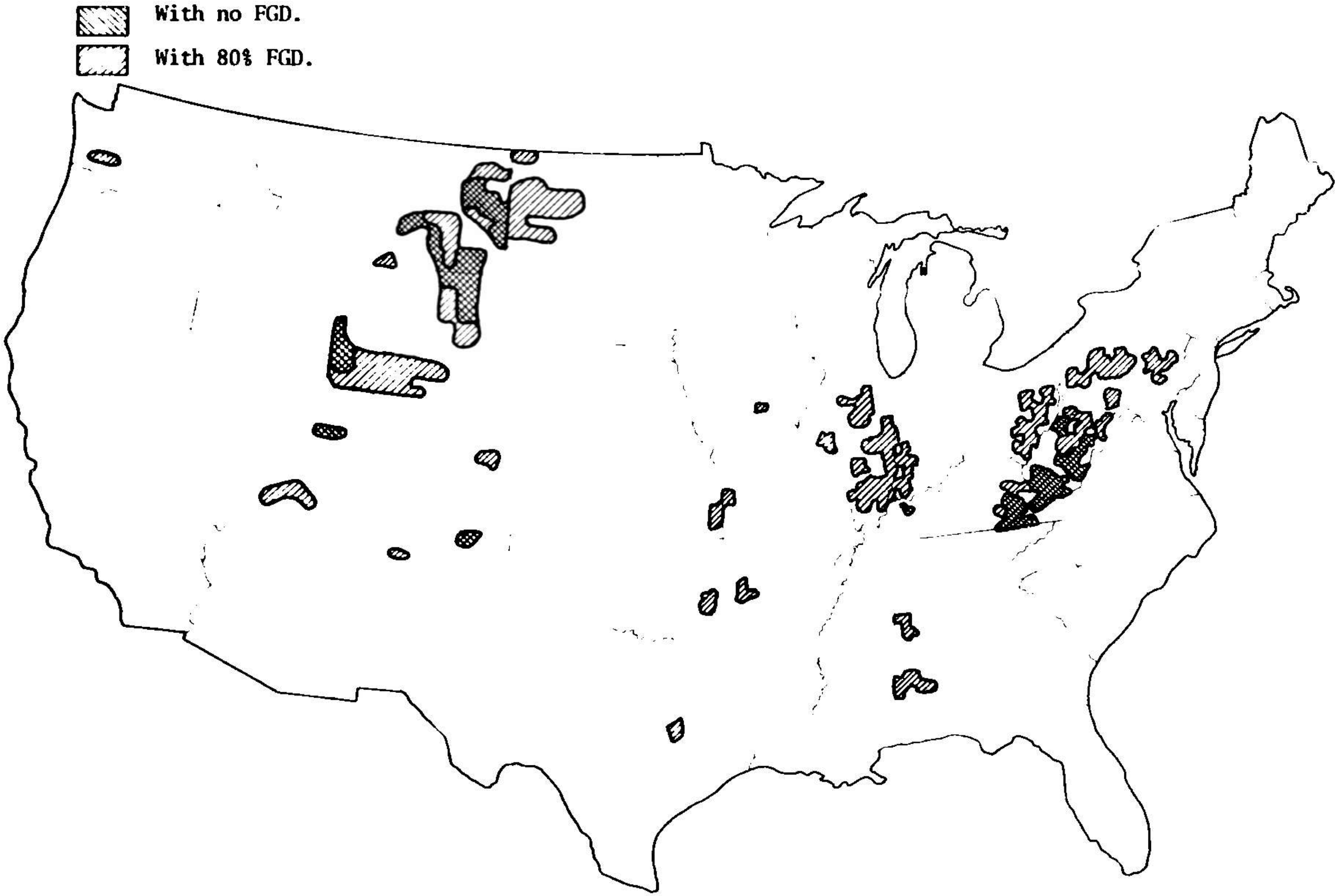


Fig. 16. Areas Most Likely to Provide Suitable Sites for 5000-Mwe Spread-out FECs Complying with NSPS and the EPA/Senate Class II Increment

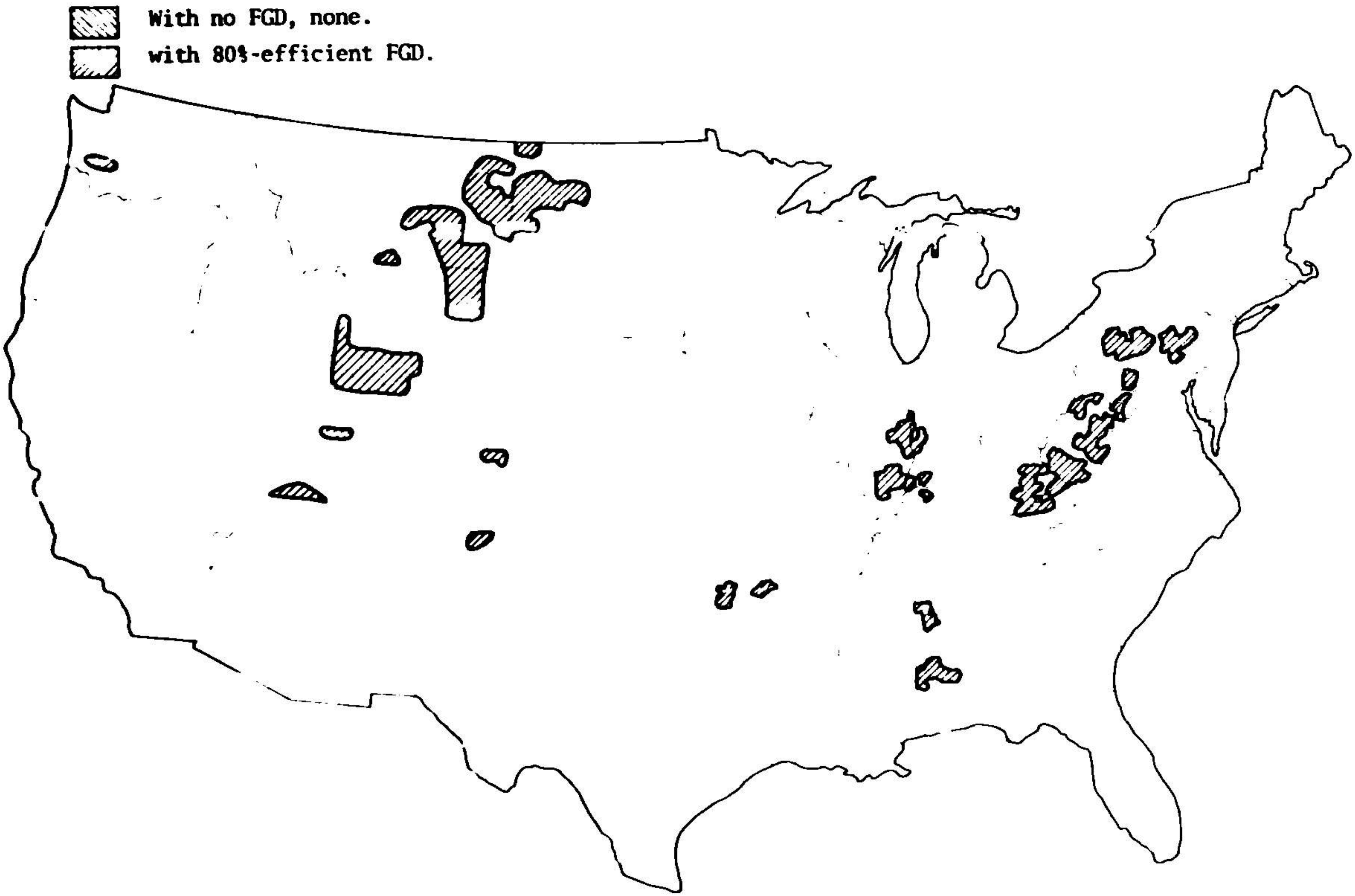
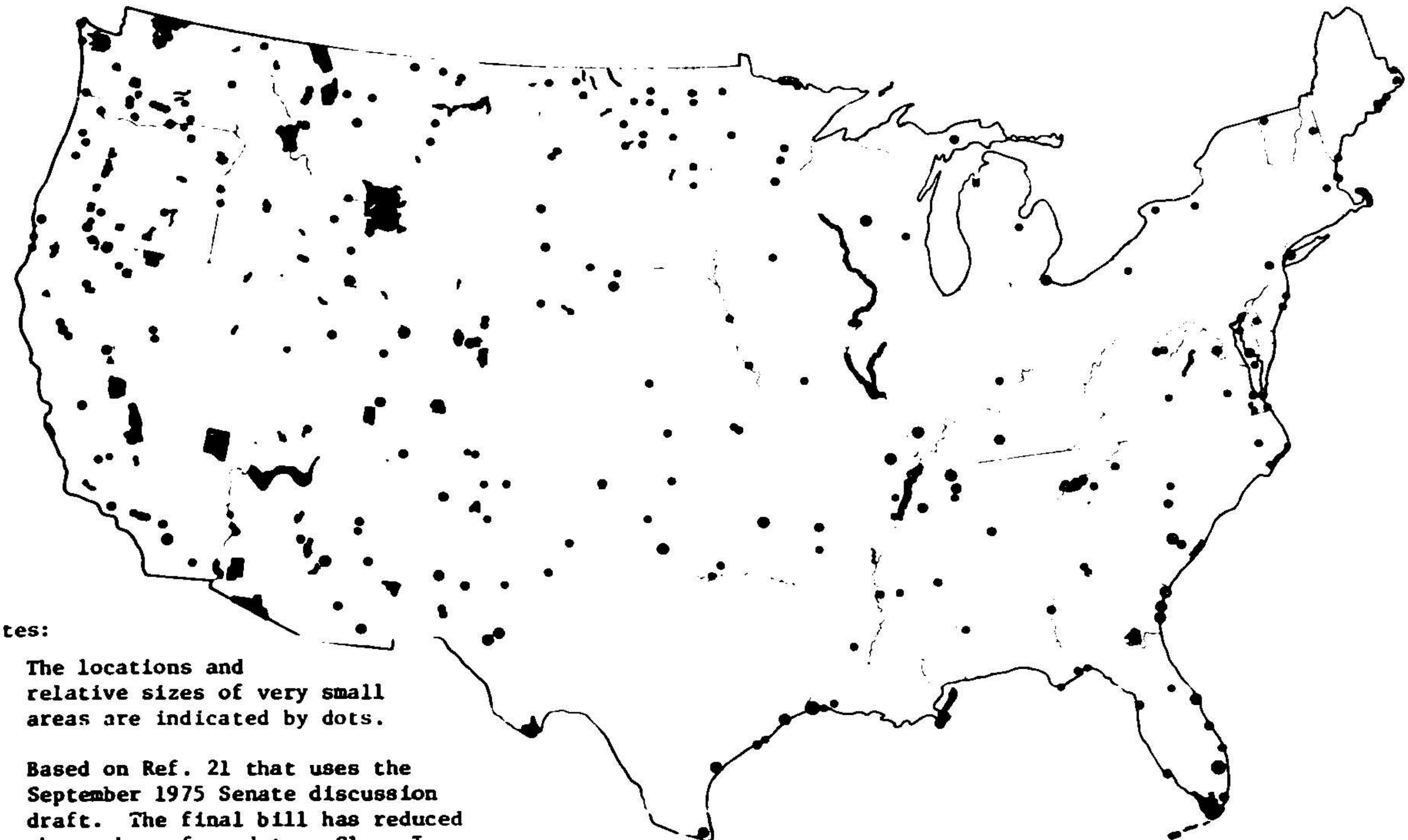


Fig. 17. Areas Most Likely to Provide Suitable Sites for 5000-Mwe Basic FECs Complying with the EPA/Senate Class II Increment



Notes:

1. The locations and relative sizes of very small areas are indicated by dots.

2. Based on Ref. 21 that uses the September 1975 Senate discussion draft. The final bill has reduced the number of mandatory Class I areas.

Fig. 18. Senate Mandatory Class I Areas

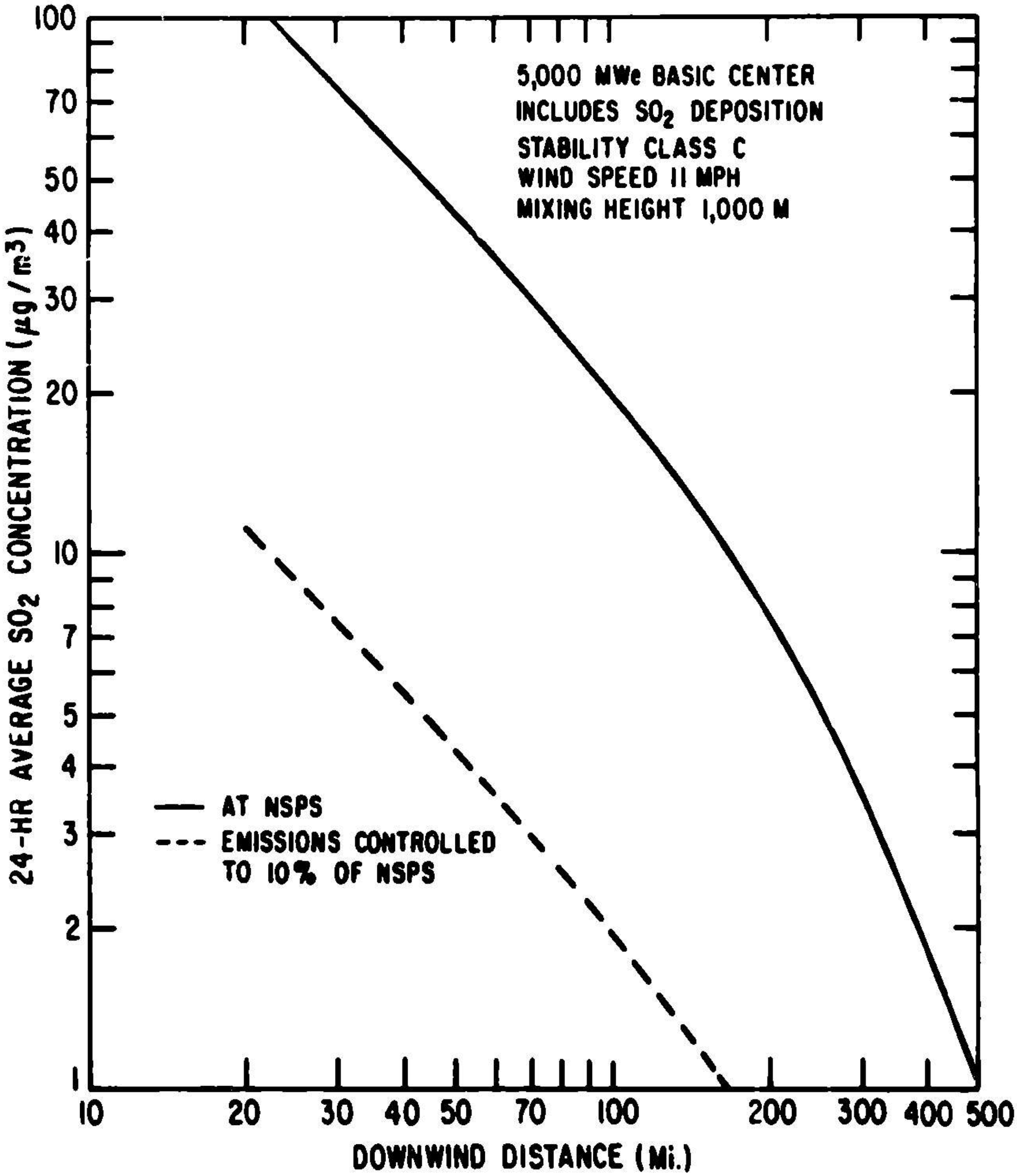
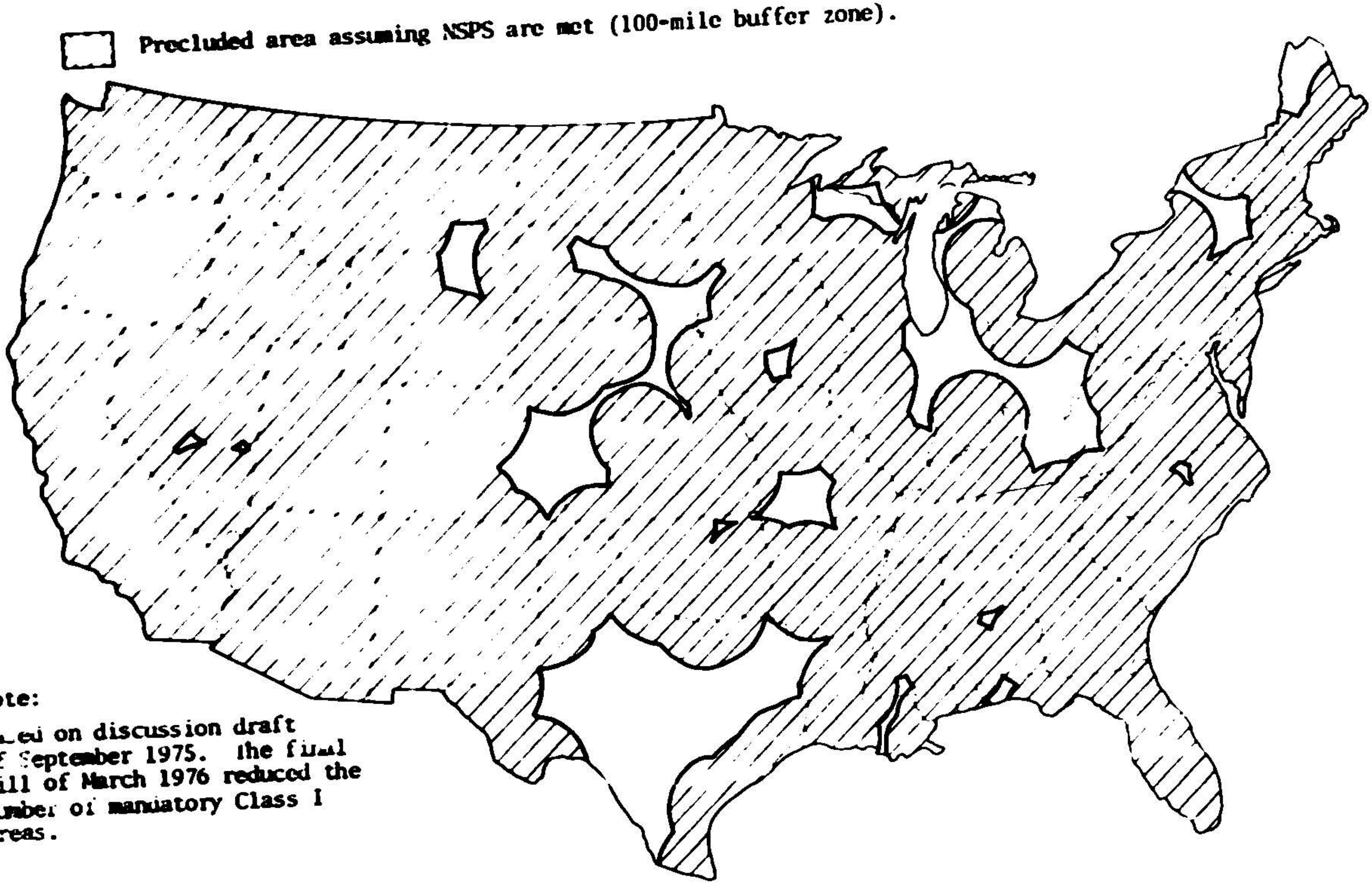


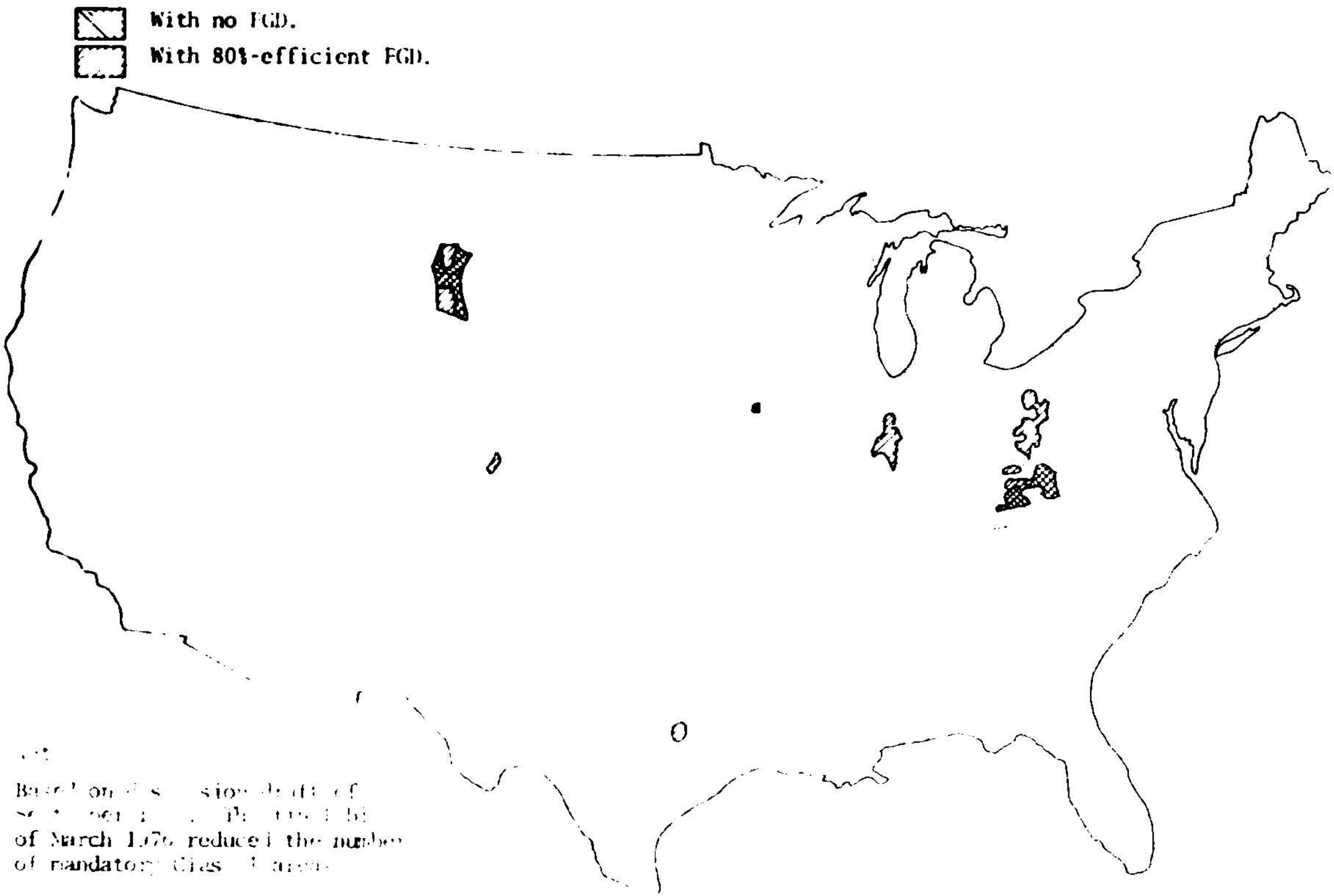
Fig. 19. Downwind SO_2 Concentration as a Function of Distance



Note:

Based on discussion draft of September 1975. The final bill of March 1976 reduced the number of mandatory Class I areas.

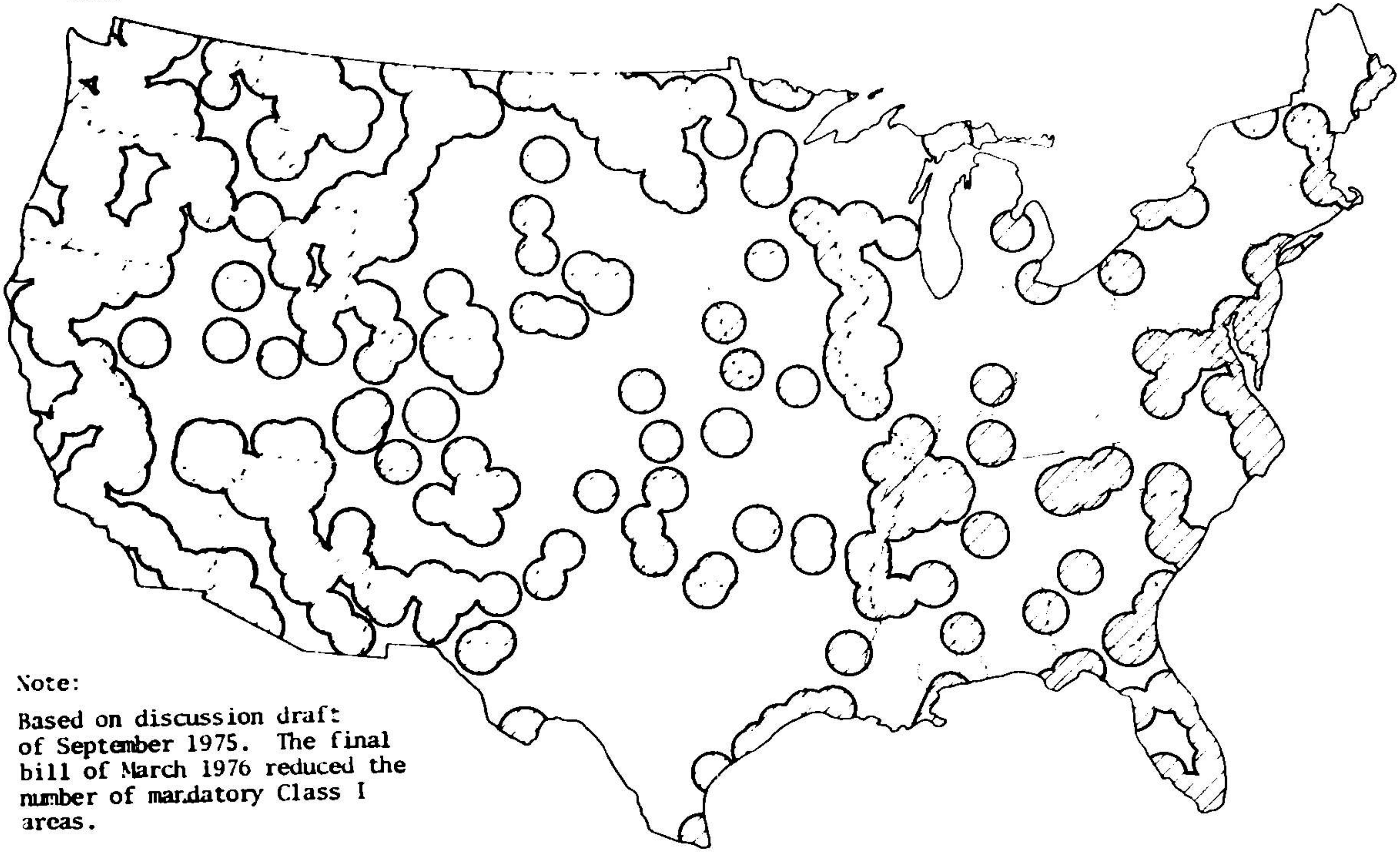
Fig. 20 Areas Possibly Precluded from Siting 5000 Mwe-FECs with the Senate Mandatory Class I Designations



Based on [illegible] sion [illegible] of
[illegible]
of March 1976 reduced the number
of mandatory Class I areas.

Fi[illegible] Areas Most Likely to Provide Suitable Sites for 5000-MWe ELCs
[illegible] with Senate Mandatory [illegible]

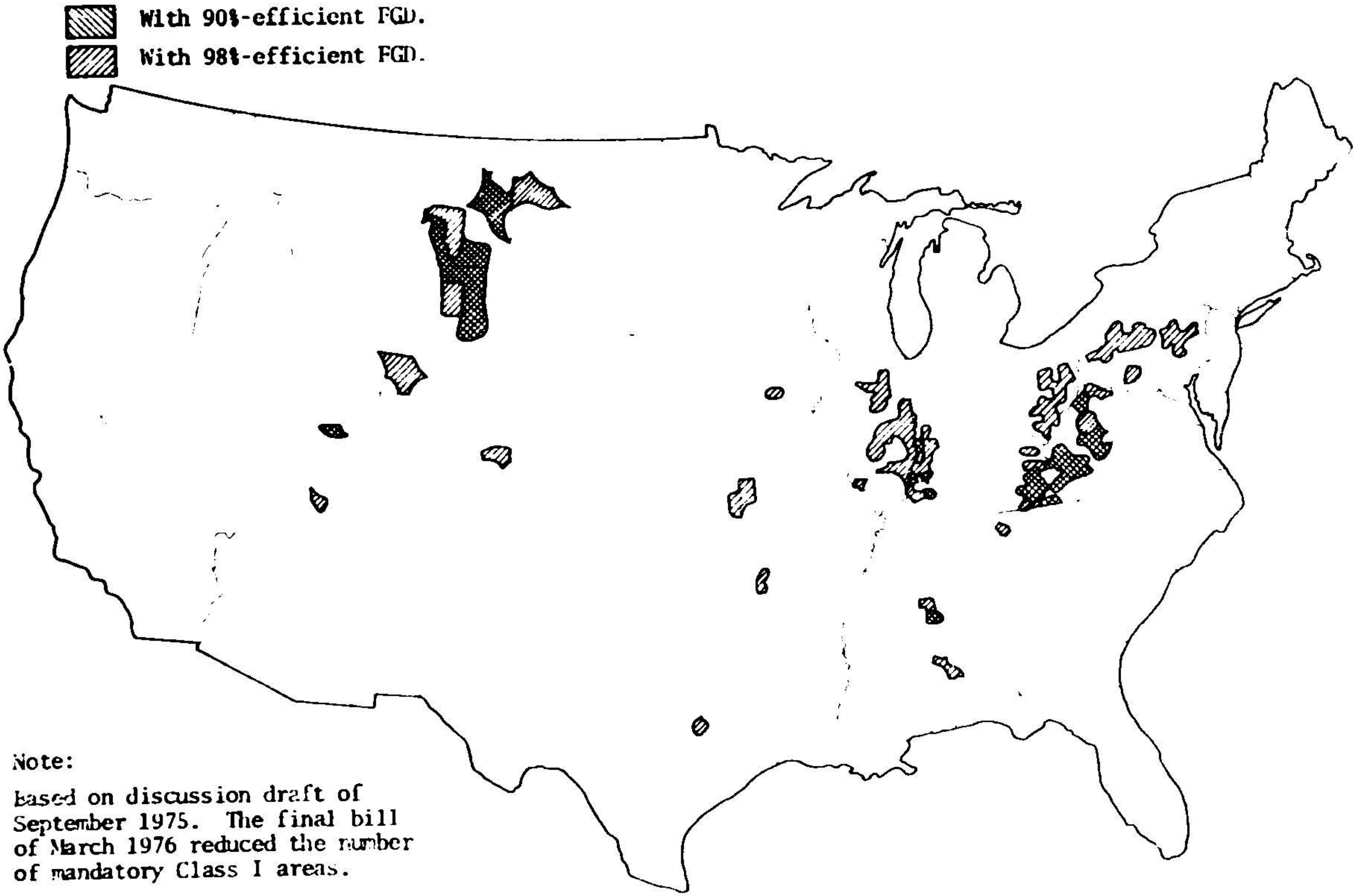
[ ] Precluded area assuming emissions reduced to 10% of NSPS (40-mile buffer zone).



Note:

Based on discussion draft of September 1975. The final bill of March 1976 reduced the number of mandatory Class I areas.

Fig. 22. Areas Possibly Precluded from Siting 5000-Mwe FECs with the Senate Mandatory Class I Designations and Reduced Emissions



Note:

Based on discussion draft of September 1975. The final bill of March 1976 reduced the number of mandatory Class I areas.

Fig. 23. Areas Most Likely to Provide Suitable Sites for 5000-Mwe EECs with Reduced Emissions and Senate Mandatory Class I Designations

Table 1. National Ambient Air Quality Standards[a]

Pollutant	Averaging Time	Primary Standards	Secondary Standards
TSP	Annual (G)	75 μg/m^3	60[c] μg/m^3
	24-hour[b]	260 μg/m^3	150 μg/m^3
SO_2	Annual (A)	80 μg/m^3	-
	24-hour[b]	365 μg/m^3	-
	3-hour[b]	-	1300 μg/m^3
NO_2	Annual (A)	100 μg/m^3	100 μg/m^3

[a]Only the standards for TSP, SO_2, and NO_2 are given.

[b]Not to be exceeded more than once a year.

[c]To be used as a guide for achieving the secondary 24-hour standard.

(A) Arithmetic mean

(G) Geometric mean

Table 2. Maximum Ground Level Concentrations from FECs Compared to NAAQS[a]

Configuration	Averaging Time	SO_2 Maximum Concentration ($\mu g/m^3$)	SO_2 Percentage of NAAQS (%)	NO_2 Maximum Concentration ($\mu g/m^3$)	NO_2 Percentage of NAAQS (%)	Particulates Maximum Concentration ($\mu g/m^3$)	Particulates Percentage of NAAQS (%)
Basic	3 hr	2185[c]	168	-	-	-	-
	24 hr	1442[c]	395	-	-	121	81
	1 yr	32.4	40	19	19	2.7	3.6
Spread-out	3 hr	931[d]	72	-	-	-	
	24 hr	614[d]	168	-	-	e	-
	1 yr	29.9	37	e	-	e	-

[a]Based on Ref. 1 estimates for a 26,240-Mwe center.

[b]Based on primary annual standard and 24-hour secondary standard.

[c]Meteorological conditions: Stability class B, wind speed = 4.5 m/sec, and mixing height = 1,000 m.

[d]Meteorological conditions: Stability class A, wind speed = 2.5 m/sec, and mixing height = 1,000 m.

[e]Concentrations not given in Ref. 1 but would be lower than corresponding values for basic center.

Table 3. Coal Requirements for FECs

(A) Coal Quality

Capacity (Mwe)	S/H (% S/10³ Btu/lb)[a,b] Flue Gas Desulfurization Efficiency: Basic Center 0%	Basic Center 80%	Spread-out Center 0%	Spread-out Center 80%
5,000	.063[c]	.316[c]	.063[c]	.316[c]
10,000	.042	.210	.063[c]	.316[c]
20,000	.021	.100	.050	.246

(B) Coal Quantity

Capacity (Mwe)	Coal Quantity (10^6 T)[d] Heating Value (10^3 Btu/lb): 8	12	14.5
5,000	650	430	360
10,000	1290	860	710
20,000	2580	1720	1430

[a] Center required to meet both NSPS and NAAQS.

[b] These results are quite sensitive to the assumed FGD efficiency. With 90%-efficient FGD, coals with S/H values twice those listed in the 80% column could be used; that is, coals with twice the sulfur content for the same heating value.

[c] Limited by NSPS.

[d] Based on 75% capacity factor and 35-year unit lifetime.

Table 4. Stringency of State Air Quality Standards Compared to NAAQS

State	State Air Quality Standards Equivalent to NAAQS		State Air Quality Standards More Stringent than NAAQS[a]	
	TSP	SO_2	TSP	SO_2
Alabama	X	X		
Arizona			X[b]	X
Arkansas		X	X[b]	
California			X	X
Colorado			X	X[c]
Connecticut			X[b]	X[c]
Delaware			X[b]	X[c]
District of Columbia			X	X
Florida			X[b]	X[c]
Georgia			X[b]	X
Idaho		X	X[b]	
Illinois	X	X		
Indiana			X[b]	X[c]
Iowa		X	X[b]	
Kansas		X	X[b]	
Kentucky			X[b]	X[c]
Louisiana			X[b]	X[c]
Maine			X	X
Maryland			X	X
Massachusetts	X	X		
Michigan		X	X[b]	
Minnesota			X[b]	X
Mississippi			X[b]	X[c]
Missouri	X			X[d]
Montana	X			X[c]
Nebraska		X	X[b]	
Nevada			X[b]	X[c]
New Hampshire			X[b]	X[c]
New Jersey		X	X[b]	
New Mexico			X[b]	X[c]
New York			X	X
North Carolina			X[b]	X[c]
North Dakota			X[b]	X[c]
Ohio			X[b]	X[c]
Oklahoma		X	X[b]	
Oregon			X[b]	X[c]
Pennsylvania		X	X[b]	
Rhode Island			X	X
South Carolina		X	X[b]	
South Dakota			X[b]	X[c]
Tennessee			X[b]	X[c]
Texas		X	X[b]	
Utah	X	X		
Vermont			X	X
Virginia		X	X[b]	
Washington			X[b]	X
West Virginia			X[b]	X[c]
Wisconsin			X[b]	X[c]
Wyoming			X[b]	X[c]

Table 4. (Contd.)

[a]State standards were rated more stringent than NAAQS if, for some averaging time, the state standards required either a lesser average value or fewer periods above a specified concentration, or if the state had standards for averaging times other than those used in the NAAQS. States with either no standards or less stringent standards were rated as having standards equivalent to NAAQS, since in both cases the NAAQS would apply.

[b]State retains annual TSP standard equivalent to original TSP secondary NAAQS which has been designated as a guide at the federal level.

[c]State retains annual and/or 24-hour SO_2 standards equivalent to original SO_2 secondary NAAQS which have been rescinded at the federal level.

[d]In a portion of the state.

Table 5. Coal Reserves Averaged by State

State[b]	Average Heating Value (10^3Btu/lb)	Fraction of State Reserves[a] — Sulfur Content/Heating Value (%S/10^3Btu/lb) .021	.042	.050	.063[c]	.100	.210	.246	.316
Alabama	13.0	0	0	.013	.275	.702	1	1	1
Arizona	10.5	0	0	0	0	.940	1	1	1
Arkansas	13.5	0	0	.034	.042	.680	1	1	1
Colorado	11.5	.013	.537	.632	.708	.926	1	1	1
Illinois	11.0	0	0	0	0	.085	.157	.189	.349
Indiana	11.5	0	0	0	.085	.227	.378	.445	.780
Iowa	10.0	0	0	0	0	0	0	0	.284
Kansas	12.0	0	0	0	0	0	.212	.359	.565
Kentucky	12.5	0	.068	.072	.301	.440	.501	.506	.840
Maryland	13.5	0	0	0	0	.406	.775	.929	1
Michigan	11.5	0	0	0	0	0	.766	.946	1
Missouri	11.0	0	0	0	0	0	0	.106	.109
Montana	8.5	0	.682	.716	.973	.988	.997	.997	1
New Mexico	12.0	0	.401	.401	.984	.988	1	1	1
North Dakota	6.5	0	.040	.052	.052	.478	.991	.991	1
Ohio	12.0	0	0	0	0	0	.213	.486	.777
Oklahoma	13.0	0	.083	.083	.318	.418	.723	.725	.926
Pennsylvania	13.0	0	.001	.020	.021	.106	.798	.923	.991
South Dakota	6.5	0	0	0	0	.650	1	1	1
Tennessee	13.0	0	.025	.025	.197	.448	.749	.920	1
Texas	8.5	0	0	0	0	0	1	1	1
Utah	12.0	0	.765	.765	.765	.795	1	1	1
Virginia	13.5	.002	.317	.482	.713	.922	1	1	1
Washington	8.5	0	.163	.164	.176	.836	1	1	1
West Virginia	13.5	0	.163	.265	.440	.554	.827	.876	.962
Wyoming	9.0	0	.371	.371	.455	.964	.999	.999	.999

[a]Entries give fraction of reserves with S/H ratio less than or equal to the indicated values and hence are cumulative in any row.

[b]Only those states having coal reserves are listed.

[c]Meets federal New Source Performance Standards (NSPS) without flue gas desulfurization.

Table 6. Coal Reserves by Sulfur Content to Heating Value Ratio

		Coal Reserves[a] (10^6 Tons)							
		Sulfur Content/Heating Value (\$ S/10^3 BTU/lb)							
State	County[b]	.021	.042	.050	.063[c]	.100	.210	.246	.316
Alabama	Barbour	0	0	0	3	7	10	10	10
	Blount	0	0	0	2	2	2	2	2
	Choctaw	0	0	1	27	68	98	98	98
	Coffee	0	0	1	23	68	98	98	9[illegible]
	Crenshaw	0	0	2	41	105	150	150	15[illegible]
	Cullman	0	0	0	32	32	32	32	3[illegible]
	Dale	0	0	0	1	4	5	5	[illegible]
	DeKalb	0	0	0	0	1	1	1	[illegible]
	Fayette	0	0	1	27	68	97	97	9[illegible]
	Jackson	0	0	0	8	22	31	31	3[illegible]
	Jefferson	0	0	22	22	528	802	802	80[illegible]
	Marengo	0	0	7	138	351	500	500	50[illegible]
	Marion	0	0	0	0	124	124	124	12[illegible]
	Pike	0	0	1	25	63	90	90	9[illegible]
	Shelby	0	0	0	0	1	3	3	[illegible]
	St. Clair	0	0	0	1	3	4	4	[illegible]
	Sumter	0	0	0	0	1	1	1	[illegible]
	Tuscaloosa	0	1	1	1	157	157	163	16[illegible]
	Walker	0	0	0	427	443	688	688	68[illegible]
	Wilcox	0	0	1	21	53	75	75	7[illegible]
	Winston	0	0	0	2	6	8	8	[illegible]
Arizona	Apache	0	0	0	0	0	21	21	2[illegible]
	Coconino	0	0	0	0	35	35	35	3[illegible]
	Navajo	0	0	0	0	294	294	294	29[illegible]
Arkansas	Bradley	0	0	0	0	0	0	0	0
	Calhoun	0	0	0	0	0	0	0	0
	Clark	0	0	0	0	0	0	0	0
	Cleveland	0	0	0	0	0	0	0	0
	Crawford	0	0	1	1	19	28	28	28
	Dallas	0	0	0	0	3	5	5	5
	Franklin	0	0	0	0	0	55	55	55
	Grant	0	0	0	0	0	0	0	0
	Greene	0	0	0	0	0	0	0	0
	Hot Spring	0	0	0	0	0	0	0	0
	Johnson	0	0	20	20	20	139	139	139
	Logan	0	0	0	0	0	43	43	43
	Nevada	0	0	0	0	0	0	0	0
	Ouachita	0	0	0	0	4	5	5	5
	Poinsett	0	0	0	0	1	1	1	1
	Pope	0	0	0	0	0	10	10	10
	Pulaski	0	0	0	1	9	13	13	13
	Saline	0	0	0	0	4	7	7	7
	Scott	0	0	0	0	18	18	18	18
	Sebastian	0	0	0	5	340	340	340	340
Colorado	Adams	2	66	78	87	114	123	123	123
	Arapahoe	1	38	44	50	65	70	70	70
	Archuleta	0	92	92	92	92	92	92	92
	Boulder	2	88	103	116	151	163	163	163
	Delta	213	271	271	271	271	271	271	271
	Douglas	0	3	3	4	5	5	5	5
	El Paso	0	0	0	0	249	249	249	249
	Elbert	2	67	78	88	115	124	124	124
	Fremont	0	82	82	150	157	180	180	180
	Garfield	0	544	544	544	553	553	553	553
	Gunnison	0	944	944	944	944	944	944	944
	Huerfano	0	142	142	278	278	278	278	278
	Jackson	0	951	951	951	951	951	951	951
	Jefferson	0	176	176	176	176	176	176	176

Table 6. (Contd.)

State	County[b]	Coal Reserves[a] (10^6 Tons)							
		Sulfur Content/Heating Value (lb S/10^3 BTU/lb)							
		.021	.042	.050	.063[c]	.100	.210	.246	.316
Colorado (Contd.)	Lake	0	0	0	0	0	322	322	322
	Las Animas	0	701	701	831	831	831	831	831
	Mesa	0	132	132	239	239	239	239	239
	Moffat	0	2,841	2,841	2,841	2,841	2,841	2,841	2,841
	Montezuma	0	19	19	19	19	19	19	19
	Montrose	0	0	0	203	203	203	203	203
	Ouray	10	410	482	540	706	763	763	763
	Park	1	14	16	18	23	25	25	25
	Pitkin	0	62	62	62	88	88	88	88
	Rio Blanco	0	1,067	1,067	1,067	1,067	1,067	1,067	1,067
	Routt	0	1,052	1,994	1,994	3,664	3,827	3,827	3,827
	Weld	0	464	464	464	464	464	464	464
Georgia	Long	0	0	0	0	0	0	0	0
	Walker	0	0	0	0	0	0	0	0
Illinois	Adams	0	0	0	0	6	11	13	24
	Bond	0	0	0	0	0	0	0	0
	Brown	0	0	0	0	7	13	16	29
	Bureau	0	0	0	0	0	0	0	0
	Calhoun	0	0	0	0	1	1	1	2
	Cass	0	0	0	0	10	18	22	41
	Christian	0	0	0	0	0	0	0	0
	Clark	0	0	0	0	14	26	32	59
	Clinton	0	0	0	0	0	0	0	0
	Coles	0	0	0	0	7	13	15	28
	Crawford	0	0	0	0	38	69	84	154
	Cumberland	0	0	0	0	0	1	1	1
	Douglas	0	0	0	0	0	412	412	412
	Edgar	0	0	0	0	149	275	331	611
	Edwards	0	0	0	0	5	8	10	19
	Fayette	0	0	0	0	100	184	222	410
	Franklin	0	0	0	0	3,038	3,038	3,038	3,038
	Fulton	0	0	0	0	0	0	0	2,031
	Gallatin	0	0	0	0	0	0	0	1,991
	Greene	0	0	0	0	40	75	90	166
	Grundy	0	0	0	0	0	0	0	627
	Hamilton	0	0	0	0	207	383	461	852
	Hancock	0	0	0	0	2	4	5	10
	Henry	0	0	0	0	0	0	0	0
	Jackson	0	0	0	0	142	142	526	526
	Jefferson	0	0	0	0	1,801	1,801	1,801	1,801
	Jersey	0	0	0	0	14	25	31	57
	Kankakee	0	0	0	0	0	0	0	95
	Knox	0	0	0	0	0	0	0	556
	Lake	0	0	0	0	0	0	0	0
	Lawrence	0	0	0	0	76	140	169	312
	Livingston	0	0	0	0	53	98	118	218
	Logan	0	0	0	0	0	0	0	0
	McDonough	0	0	0	0	4	7	9	16
	McLean	0	0	0	0	36	66	80	147
	Macon	0	0	0	0	0	0	0	0
	Macoupin	0	0	0	0	0	0	0	0
	Madison	0	0	0	0	0	0	0	0
	Marion	0	0	0	0	0	0	0	0
	Marshall	0	0	0	0	40	74	90	165
	Menard	0	0	0	0	124	229	276	510
	Mercer	0	0	0	0	4	8	10	18
	Monroe	0	0	0	0	1	1	1	2
	Montgomery	0	0	0	0	0	0	0	0
	Morgan	0	0	0	0	34	62	75	138
	Moultrie	0	0	0	0	10	19	23	43
	Peoria	0	0	0	0	0	0	0	755

Table 6. (Contd.)

State	County[b]	Coal Reserves[a] (10^6 Tons) Sulfur Content/Heating Value (% S/10^3 BTU/lb) .021	.042	.050	.063[c]	.100	.210	.246	.316
Illinois (Contd.)	Perry	0	0	0	0	0	0	0	1,833
	Putnam	0	0	0	0	50	92	111	206
	Randolph	0	0	0	0	0	0	0	0
	Rock Island	0	0	0	0	3	6	7	14
	Saline	0	0	0	0	0	0	0	0
	Sangamon	0	0	0	0	0	1,971	1,971	1,971
	Schuyler	0	0	0	0	0	0	0	0
	Scott	0	0	0	0	0	0	0	0
	Shelby	0	0	0	0	14	26	31	58
	St. Clair	0	0	0	0	62	114	137	253
	Stark	0	0	0	0	0	0	0	0
	Tazewell	0	0	0	0	0	0	0	167
	Vermilion	0	0	0	0	0	687	687	1,[illegible]97
	Wabash	0	0	0	0	24	45	54	100
	Warren	0	0	0	0	2	3	4	7
	Washington	0	0	0	0	0	0	0	0
	Wayne	0	0	0	0	8	14	17	31
	White	0	0	0	0	84	156	189	346
	Will	0	0	0	0	0	0	15	15
	Williamson	0	0	0	0	0	903	2,103	2,103
	Woodford	0	0	0	0	0	214	214	214
Indiana	Clay	0	0	0	0	126	184	184	184
	Daviess	0	0	0	16	43	71	83	146
	Dubois	0	0	0	1	2	3	4	7
	Fountain	0	0	0	0	0	0	0	48
	Gibson	0	0	0	0	0	289	289	1,301
	Greene	0	0	0	0	0	92	92	151
	Knox	0	0	0	0	0	0	689	689
	Martin	0	0	0	2	5	8	10	17
	Owen	0	0	0	0	0	0	0	0
	Parke	0	0	0	6	16	26	31	54
	Perry	0	0	0	1	2	4	5	8
	Pike	0	0	0	0	0	1	439	439
	Posey	0	0	0	61	164	273	321	562
	Spencer	0	0	0	0	0	0	0	0
	Sullivan	0	0	0	544	1,356	2,238	2,238	2,238
	Vanderburgh	0	0	0	0	0	0	0	451
	Vermillion	0	0	0	268	268	268	268	268
	Vigo	0	0	0	0	412	538	538	834
	Warrick	0	0	0	144	144	144	277	846
Iowa	Appanoose	0	0	0	0	0	0	0	0
	Boone	0	0	0	0	0	0	0	0
	Cass	0	0	0	0	0	0	0	0
	Dallas	0	0	0	0	0	0	0	0
	Davis	0	0	0	0	0	0	0	0
	Decatur	0	0	0	0	0	0	0	33
	Greene	0	0	0	0	0	0	0	13
	Guthrie	0	0	0	0	0	0	0	5
	Hamilton	0	0	0	0	0	0	0	9
	Hardin	0	0	0	0	0	0	0	5
	Henry	0	0	0	0	0	0	0	1
	Jasper	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	49
	Keokuk	0	0	0	0	0	0	0	78
	Lee	0	0	0	0	0	0	0	3
	Lucas	0	0	0	0	0	0	0	0
	Mahaska	0	0	0	0	0	0	0	0
	Marion	0	0	0	0	0	0	0	0
	Marshall	0	0	0	0	0	0	0	3
	Monroe	0	0	0	0	0	0	0	510
	Muscatine	0	0	0	0	0	0	0	0

Table 6. (Contd.)

State	County[b]	Coal Reserves[a] (10^6 Tons) — Sulfur Content/Heating Value (lb S/10^6 Btu) .021	.042	.050	.063[c]	.100	.210	.246	.316
Iowa (Contd.)	Polk	0	0	0	0	0	0	0	[illegible]
	Scott	0	0	0	0	0	0	0	2
	Story	0	0	0	0	0	0	0	34
	Van Buren	0	0	0	0	0	0	0	[illegible]
	Wapello	0	0	0	0	0	0	0	[illegible]
	Warren	0	0	0	0	0	0	0	[illegible]
	Webster	0	0	0	0	0	0	0	44
Kansas	Atchison	0	0	0	0	0	1	2	3
	Bourbon	0	0	0	0	0	55	93	146
	Brown	0	0	0	0	0	3	5	7
	Cherokee	0	0	0	0	0	0	98	236
	Cowley	0	0	0	0	0	1	2	3
	Crawford	0	0	0	0	0	117	117	117
	Franklin	0	0	0	0	0	0	0	1
	Leavenworth	0	0	0	0	0	4	7	11
	Linn	0	0	0	0	0	101	170	268
	Nemaha	0	0	0	0	0	1	1	2
	Osage	0	0	0	0	0	0	0	0
Kentucky	Bell	0	0	0	97	181	182	196	[illegible]
	Boyd	0	8	8	35	59	57	58	96
	Breathitt	0	0	0	705	705	705	705	705
	Butler	0	16	17	73	107	121	123	203
	Carter	0	0	0	0	0	142	142	142
	Christian	0	2	2	9	13	15	15	25
	Clay	0	0	0	0	183	183	183	183
	Clinton	0	0	0	1	2	2	5	20
	Crittenden	0	0	0	0	0	14	14	14
	Daviess	0	0	0	0	0	0	0	[illegible]
	Edmonson	0	3	3	14	20	23	23	39
	Elliott	0	4	4	17	25	29	29	49
	Floyd	0	0	0	0	455	1,118	1,118	1,118
	Grayson	0	1	1	4	6	6	6	11
	Greenup	0	5	5	20	30	34	34	57
	Hancock	0	1	1	4	6	7	7	12
	Harlan	0	98	208	629	1,772	1,772	1,772	1,772
	Henderson	0	137	145	604	883	1,006	1,016	1,687
	Hopkins	0	0	0	0	0	24	773	2,452
	Jackson	0	0	0	0	0	92	92	92
	Johnson	0	0	0	0	182	182	182	182
	Knott	0	0	0	962	1,406	1,471	1,471	1,471
	Knox	0	0	0	0	69	100	100	100
	Laurel	0	0	0	0	0	7	37	37
	Lawrence	0	6	7	28	41	47	47	78
	Lee	0	2	2	10	14	16	17	28
	Leslie	0	53	57	236	345	393	397	659
	Letcher	0	0	76	385	781	781	781	900
	McCreary	0	0	0	0	0	79	79	184
	McLean	0	60	63	265	387	440	445	738
	Magoffin	0	0	0	13	311	311	311	311
	Martin	0	0	0	450	450	450	450	450
	Menifee	0	0	0	1	2	2	2	3
	Morgan	0	3	3	14	21	24	24	40
	Muhlenberg	0	0	0	0	0	42	44	44
	Ohio	0	0	0	0	0	0	23	811
	Owsley	0	0	0	1	1	1	1	2
	Perry	0	157	157	948	948	1,015	1,015	1,015
	Pike	0	1,051	1,051	2,151	2,633	2,633	2,674	2,674
	Powell	0	0	0	0	0	0	0	1
	Pulaski	0	0	0	0	0	36	36	36
	Rockcastle	0	2	2	8	11	13	13	21
	Union	0	0	0	0	0	0	0	1,576

Table 6. (Contd.)

		Coal Reserves[a] (10^6 Tons)							
		Sulfur Content/Heating Value (% S/10^3 BTU/lb)							
State	County[b]	.021	.042	.050	.063[c]	.100	.210	.246	.316
Kentucky (Contd.)	Warren	0	0	0	0	0	0	0	0
	Wayne	0	2	2	[illegible]	10	12	12	20
	Webster	0	0	0	0	0	0	0	1,572
	Whitley	0	0	0	0	45	45	45	56
	Wolfe	0	2	2	10	15	17	17	28
Maryland	Allegany	0	0	0	0	16	239	415	415
	Garrett	0	0	0	1	386	561	566	634
Michigan	Bay	0	0	0	0	0	56	56	56
	Genesee	0	0	0	0	0	5	7	7
	Huron	0	0	0	0	0	0	0	0
	Saginaw	0	0	0	0	0	27	27	27
	Shiawassee	0	0	0	0	0	2	2	2
	Tuscola	0	0	0	0	0	0	20	20
Missouri	Adair	0	0	0	0	0	0	0	0
	Audrain	0	0	0	0	0	0	58	60
	Barton	0	0	0	0	0	0	0	0
	Bates	0	0	0	0	0	0	442	442
	Boone	0	0	0	0	0	0	29	30
	Caldwell	0	0	0	0	0	0	14	14
	Callaway	0	0	0	0	0	0	0	0
	Carroll	0	0	0	0	0	0	21	21
	Cass	0	0	0	0	0	0	8	8
	Cedar	0	0	0	0	0	0	2	2
	Chariton	0	0	0	0	0	0	24	25
	Clay	0	0	0	0	0	0	0	0
	Dade	0	0	0	0	0	0	2	2
	Daviess	0	0	0	0	0	0	0	0
	Grundy	0	0	0	0	0	0	3	3
	Harrison	0	0	0	0	0	0	24	24
	Henry	0	0	0	0	0	0	0	0
	Howard	0	0	0	0	0	0	25	26
	Jasper	0	0	0	0	0	0	7	7
	Johnson	0	0	0	0	0	0	0	0
	Lafayette	0	0	0	0	0	0	0	0
	Linn	0	0	0	0	0	0	60	62
	Livingston	0	0	0	0	0	0	7	7
	Macon	0	0	0	0	0	0	0	0
	Mercer	0	0	0	0	0	0	62	64
	Monroe	0	0	0	0	0	0	4	4
	Montgomery	0	0	0	0	0	0	16	16
	Nodaway	0	0	0	0	0	0	2	2
	Pettis	0	0	0	0	0	0	4	4
	Putnam	0	0	0	0	0	0	59	52
	Ralls	0	0	0	0	0	0	2	2
	Randolph	0	0	0	0	0	0	0	0
	Ray	0	0	0	0	0	0	0	0
	St. Clair	0	0	0	0	0	0	0	0
	Saline	0	0	0	0	0	0	8	9
	Scotland	0	0	0	0	0	0	8	8
	Sullivan	0	0	0	0	0	0	40	42
	Vernon	0	0	0	0	0	0	0	15
	Worth	0	0	0	0	0	0	2	2
Montana	Big Horn	0	38,355	38,355	38,355	38,355	38,355	38,355	38,355
	Blaine	0	18	18	18	18	18	18	18
	Broadwater	0	4	4	6	6	6	6	6
	Carbon	0	0	0	0	0	735	735	735
	Cascade	0	0	0	0	0	0	0	309
	Chouteau	0	0	0	0	0	0	0	0

Table 6. (Contd.)

State	County[b]	Coal Reserves[a] (10^6 Tons)							
		Sulfur Content/Heating Value (lb S/10^6 BTU)							
		.021	.042	.050	.063[c]	.100	.210	.246	.316
Montana (Contd.)	Custer	0	3,684	3,684	3,684	3,684	3,684	3,684	3,684
	Dawson	0	751	789	1,072	1,089	1,099	1,099	1,102
	Fallon	0	102	107	146	148	150	150	150
	Fergus	0	0	0	0	0	210	210	210
	Garfield	0	94	98	133	136	137	137	137
	Glacier	0	17	18	25	25	25	25	25
	Judith Basin	0	62	65	88	89	90	90	90
	McCone	0	796	835	1,135	1,153	1,163	1,163	1,167
	Meagher	0	0	0	1	1	1	1	1
	Musselshell	0	0	3,467	3,467	3,467	3,467	3,467	3,467
	Powder River	0	27,813	27,813	27,813	27,813	27,813	27,813	27,813
	Prairie	0	0	0	0	200	200	200	200
	Richland	0	0	0	0	876	876	876	876
	Roosevelt	0	294	309	419	426	430	430	431
	Rosebud	0	0	0	0	26,264	26,264	26,264	26,264
	Sheridan	0	0	0	454	454	454	454	454
	Stillwater	0	5	6	8	8	8	8	8
	Treasure	0	889	933	1,268	1,288	1,300	1,300	1,304
	Wibaux	0	682	716	973	988	997	997	1,000
	Yellowstone	0	403	423	574	583	588	588	590
New Mexico	Colfax	0	1,381	1,381	1,381	1,381	1,381	1,381	1,381
	Lincoln	0	7	7	7	7	7	7	7
	McKinley	0	364	364	364	364	364	364	364
	Rio Arriba	0	0	0	0	8	8	8	8
	Sandoval	0	0	0	0	0	52	52	52
	San Juan	0	0	0	2,545	2,545	2,545	2,545	2,545
	Santa Fe	0	0	0	0	11	11	11	11
	Socorro	0	11	11	27	27	28	28	28
	Valencia	0	0	0	0	0	0	0	0
North Carolina[d]		-	-	-	-	-	-	-	
North Dakota	Adams	0	0	0	0	0	163	163	163
	Billings	0	43	56	56	515	1,068	1,068	1,078
	Bowman	0	0	0	0	0	785	785	785
	Burke	0	0	0	0	117	117	117	117
	Burleigh	0	0	0	0	156	156	156	156
	Divide	0	0	0	0	137	137	137	137
	Dunn	0	0	0	0	0	2,000	2,000	2,000
	Golden Valley	0	0	0	0	0	278	278	278
	Grant	0	0	0	0	0	0	115	115
	Hettinger	0	0	0	0	0	980	980	980
	McHenry	0	1	1	1	7	15	15	15
	McKenzie	0	0	0	0	0	825	825	825
	McLean	0	0	0	0	1,009	1,009	1,009	1,009
	Mercer	0	0	0	0	1,986	1,986	1,986	1,986
	Morton	0	0	0	0	0	342	342	342
	Mountrail	0	0	148	148	148	148	148	148
	Oliver	0	0	0	0	0	629	629	629
	Renville	0	0	0	0	4	8	8	8
	Slope	0	93	121	121	1,112	2,305	2,305	2,326
	Stark	0	0	0	0	0	1,275	1,275	1,275
	Ward	0	501	501	501	501	501	501	501
	Williams	0	0	0	0	0	1,130	1,130	1,130
Ohio	Athens	0	0	0	0	0	1,022	1,295	1,480
	Belmont	0	0	0	0	0	0	1,290	4,218
	Carroll	0	0	0	0	0	298	298	710
	Columbiana	0		0	0	0	711	758	758
	Coshocton	0	0	0	0	0	0	0	273
	Gallia	0	0	0	0	0	0	0	421
	Guernsey	0	0	0	0	0	1,131	1,131	1,131
	Harrison	0	0	0	0	0	141	1,327	1,745

Table 6. (Contd.)

State	County[b]	Coal Reserves[a] (10^6 Tons) — Sulfur Content/Heating Value (% S/10^3 BTU/lb) .021	.042	.050	.063[c]	.100	.210	.246	.316
Ohio (Contd.)	Hocking	0	0	0	0	0	215	221	2[illegible]1
	Holmes	0	0	0	0	0	0	68	68
	Jackson	0	0	0	0	0	135	354	354
	Jefferson	0	0	0	0	0	0	1,695	1,695
	Lorain	0	0	0	0	0	347	347	347
	Mahoning	0	0	0	0	0	0	0	318
	Meigs	0	0	0	0	0	0	0	486
	Monroe	0	0	0	0	0	100	228	364
	Morgan	0	0	0	0	0	222	222	222
	Muskingum	0	0	0	0	0	0	0	0
	Noble	0	0	0	0	0	182	182	182
	Perry	0	0	0	0	0	39	911	911
	Scioto	0	0	0	0	0	1	3	5
	Stark	0	0	0	0	0	0	0	1[illegible]5
	Tuscarawas	0	0	0	0	0	0	0	[illegible]
	Vinton	0	0	0	0	0	135	135	1[illegible]
	Washington	0	0	0	0	0	0	0	[illegible]
	Wayne	0	0	0	0	0	1	3	4
Oklahoma	Atoka	0	1	1	5	6	11	11	[illegible]4
	Coal	0	0	0	0	0	0	0	[illegible]
	Craig	0	0	43	43	43	43	43	2[illegible]8
	Haskell	0	0	0	90	140	140	140	1[illegible]
	Latimre	0	0	0	0	0	84	84	[illegible]4
	Le Flore	0	0	0	0	298	316	316	31[illegible]
	Mayes	0	0	0	2	2	4	4	[illegible]
	Muskogee	0	0	0	0	0	0	0	[illegible]
	Nowata	0	6	6	25	32	56	56	[illegible]
	Okfuskee	0	0	0	1	1	2	2	[illegible]
	Okmulgee	0	0	0	0	0	125	125	12[illegible]
	Pittsburg	0	0	0	0	90	157	157	15[illegible]
	Rogers	0	0	0	26	42	42	42	4[illegible]
	Sequoyah	0	9	9	9	9	9	9	[illegible]
	Tulsa	0	0	0	0	0	0	2	1[illegible]
	Wagoner	0	0	4	4	4	4	4	[illegible]
Oregon	Coos	0	1	1	1	1	2	2	[illegible]
Pennsylvania	Allegheny	0	0	440	440	440	902	902	90[illegible]
	Armstrong	0	0	0	0	0	645	664	1,18[illegible]
	Beaver	0	0	0	0	50	402	501	50[illegible]
	Bedford	0	0	0	0	28	90	90	9[illegible]
	Blair	0	0	0	2	2	2	19	1[illegible]
	Bradford	0	0	0	0	1	10	12	1[illegible]
	Butler	0	0	0	0	0	539	879	87[illegible]
	Cambria	0	0	0	0	706	1,517	1,518	1,51[illegible]
	Cameron	0	0	0	0	1	10	12	1[illegible]
	Carbon	0	0	2	2	11	88	93	9[illegible]
	Centre	0	0	0	0	0	230	230	23[illegible]
	Clarion	0	0	0	0	8	317	317	76[illegible]
	Clearfield	0	0	0	0	225	985	1,220	1,22[illegible]
	Clinton	0	0	0	0	0	19	44	4[illegible]
	Columbia	0	0	4	4	20	149	173	18[illegible]
	Dauphin	0	0	7	8	38	289	335	35[illegible]
	Elk	0	0	0	0	16	87	87	8[illegible]
	Fayette	0	0	0	0	0	979	1,078	1,07[illegible]
	Fulton	0	0	0	0	1	9	10	1[illegible]
	Greene	0	0	0	0	0	5,178	6,597	6,59[illegible]
	Huntingdon	0	0	0	0	32	36	36	3[illegible]
	Indiana	0	0	0	0	448	1,042	1,747	1,74[illegible]
	Jefferson	0	14	14	14	325	457	457	45[illegible]
	Lancaster	0	0	0	0	0	13	15	18[illegible]
	Lawrence	0	0	9	9	48	359	415	44[illegible]

Table 6. (Contd.)

State	County[b]	Coal Reserves[a] (10^6 Tons) — Sulfur Content/Heating Value (% S/10^6 BTU/lb) .021	.042	.050	.063[c]	.100	.210	.246	.316
Pennsylvania (Contd.)	Lebanon	0	0	7	8	39	233	339	364
	Luzerne	0	1	12	13	66	497	575	618
	Lycoming	0	0	0	0	1	10	11	12
	McKean	0	0	0	0	0	0	0	151
	Mercer	0	0	0	0	0	0	0	165
	Northumberland	0	1	13	15	77	580	671	721
	Schuylkill	0	4	87	91	459	3,456	3,997	4,292
	Somerset	0	0	0	5	6	1,293	1,299	1,299
	Sullivan	0	0	0	0	2	15	18	19
	Tioga	0	0	0	0	0	19	19	35
	Venango	0	0	0	0	0	0	0	0
	Washington	0	0	0	0	0	3,290	3,290	3,655
	Wayne	0	0	0	0	0	2	2	2
	Westmoreland	0	0	0	0	106	765	765	765
South Dakota	Corson	0	0	0	0	0	30	30	30
	Dewey	0	0	0	0	130	130	130	130
	Harding	0	0	0	0	148	227	227	227
	Perkins	0	0	0	0	0	40	40	40
	Ziebach	0	0	0	0	1	1	1	1
Tennessee	Anderson	0	0	0	55	72	100	133	133
	Bledsoe	0	0	0	0	4	4	20	20
	Clay	0	22	22	101	199	221	269	269
	Chester	0	0	0	8	31	51	51	51
	Cumberland	0	1	1	6	13	22	27	30
	Fentress	0	0	0	0	0	50	50	50
	Grundy	0	0	0	9	9	9	9	9
	Hamilton	0	0	0	0	0	15	59	59
	Marion	0	0	0	0	42	42	45	45
	Morgan	0	0	0	10	10	89	89	89
	Overton	0	0	0	0	0	0	0	12
	Pickett	0	0	0	0	0	0	0	0
	Putnam	0	0	0	0	0	0	0	22
	Rhea	0	0	0	0	13	13	13	13
	Roane	0	0	0	0	1	1	1	1
	Scott	0	0	0	0	46	51	56	93
	Sequatchie	0	0	0	0	0	62	62	62
	Van Buren	0	0	0	0	0	18	18	18
	White	0	0	0	2	5	8	10	11
Texas	Anderson	0	0	0	0	0	85	86	86
	Angelina	0	0	0	0	0	20	20	20
	Baylor	0	0	0	0	0	209	209	209
	Bexar	0	0	0	0	0	62	62	62
	Bowie	0	0	0	0	0	58	58	58
	Brazos	0	0	0	0	0	11	11	11
	Burleson	0	0	0	0	0	16	16	16
	Caldwell	0	0	0	0	0	152	152	152
	Camp	0	0	0	0	0	27	27	27
	Cass	0	0	0	0	0	72	72	72
	Cherokee	0	0	0	0	0	44	44	44
	Fayette	0	0	0	0	0	108	108	108
	Franklin	0	0	0	0	0	12	12	12
	Freestone	0	0	0	0	0	102	102	102
	Gregg	0	0	0	0	0	16	16	16
	Grimes	0	0	0	0	0	51	51	51
	Harrison	0	0	0	0	0	124	124	124
	Henderson	0	0	0	0	0	151	151	151
	Houston	0	0	0	0	0	68	68	68
	Lee	0	0	0	0	0	25	25	25
	Leon	0	0	0	0	0	98	98	98

Table 6. (Contd.)

State	County[b]	Coal Reserves[a] (10^6 Tons) Sulfur Content/Heating Value (% S/10^3 BTU/lb) .021	.042	.050	.063[c]	.100	.210	.246	.316
Texas (Contd.)	Madison	0	0	0	0	0	30	30	30
	Marion	0	0	0	0	0	44	44	44
	Milam	0	0	0	0	0	418	418	418
	Morris	0	0	0	0	0	22	22	22
	Nacogdoches	0	0	0	0	0	18	18	18
	Panola	0	0	0	0	0	140	140	140
	Rains	0	0	0	0	0	14	14	14
	Robertson	0	0	0	0	0	112	112	112
	Rusk	0	0	0	0	0	166	166	166
	Shelby	0	0	0	0	0	74	74	74
	Titus	0	0	0	0	0	146	146	146
	Trinity	0	0	0	0	0	24	24	24
	Van Zandt	0	0	0	0	0	277	277	277
	Walker	0	0	0	0	0	32	32	32
	Washington	0	0	0	0	0	22	22	22
	Wood	0	0	0	0	0	133	133	133
Utah	Carbon	0	0	0	767	767	767	767	767
	Emery	0	87	87	87	87	87	87	87
	Garfield	0	0	0	0	1,035	1,035	1,035	1,035
	Iron	0	4	4	4	4	5	5	5
	Kane	0	0	0	0	0	1,914	1,914	1,914
	Sevier	0	0	0	0	0	152	152	152
	Uintah	0	31	31	31	32	40	40	40
	Wayne	0	31	31	31	32	41	41	41
Virginia	Buchanan	5	160	312	808	1,077	1,077	1,077	1,077
	Dickenson	0	0	458	577	577	579	579	579
	Lee	0	35	35	46	69	231	231	231
	Montgomery	0	0	0	73	73	73	73	73
	Pulaski	0	21	31	46	60	65	65	65
	Russell	0	318	351	351	456	456	456	456
	Scott	0	14	22	32	41	45	45	45
	Tazewell	0	151	183	183	215	215	215	215
	Wise	0	374	465	566	802	910	910	910
Washington	King	0	47	53	88	88	88	88	88
	Kittitas	0	64	64	64	64	64	64	64
	Lewis	0	0	0	0	1,473	1,473	1,473	1,473
	Pierce	0	11	11	11	54	65	65	65
	Thurston	0	0	0	0	0	194	194	194
	Whatcom	0	70	70	70	70	70	70	70
West Virginia	Barbour	0	0	0	0	0	645	1,077	1,077
	Boone	0	499	875	1,386	2,074	2,448	2,448	2,448
	Braxton	0	0	0	0	0	568	568	568
	Brooke	0	0	0	0	0	201	201	201
	Cabell	0	4	6	10	12	19	20	22
	Calhoun	0	1	1	2	2	4	4	4
	Clay	0	39	39	643	643	843	843	843
	Doddridge	0	40	66	109	138	205	218	239
	Fayette	0	222	787	1,069	1,069	1,071	1,071	1,071
	Gilmer	0	0	0	0	0	169	169	169
	Grant	0	0	0	0	0	283	283	283
	Greenbrier	0	0	0	190	309	309	309	309
	Hancock	0	23	38	63	79	118	125	137
	Harrison	0	0	0	0	0	0	444	444
	Kanawha	0	26	221	1,071	1,481	1,684	1,684	1,684
	Lewis	0	0	0	0	0	63	819	819
	Lincoln	0	72	117	195	246	367	388	426
	Logan	0	867	867	1,903	2,593	3,634	3,634	3,634
	McDowell	0	845	969	1,219	1,235	1,235	1,235	1,235

Table 6. (Contd.)

State	County[b]	Coal Reserves[a] (10^6 Tons) Sulfur Content/Heating Value (% S/10^3 BTU/lb) .021	.042	.050	.063[c]	.100	.210	.246	.316
West Virginia (Contd.)	Marion	0	0	0	0	0	1,381	1,381	1,381
	Marshall	0	0	0	0	0	0	0	3,045
	Mason	0	0	0	0	0	0	0	119
	Mercer	0	26	63	63	63	63	63	63
	Mineral	0	0	128	176	235	235	235	235
	Mingo	0	1,002	1,073	1,163	2,332	2,332	2,332	2,332
	Monongalia	0	0	0	0	0	3,150	3,150	3,150
	Nicholas	0	93	586	1,468	1,628	1,671	1,671	1,671
	Ohio	0	0	0	0	0	0	0	414
	Pocahontas	0	0	164	164	164	164	164	164
	Preston	0	0	0	0	0	881	881	881
	Putnam	0	0	0	0	0	0	148	148
	Raleigh	0	0	1,095	1,667	1,995	1,995	1,995	1,995
	Randolph	0	613	613	745	856	872	872	872
	Roane	0	4	6	10	13	20	21	25
	Summers	0	1	2	4	5	8	8	9
	Taylor	0	0	0	0	0	412	412	412
	Tucker	0	0	0	38	130	130	130	130
	Tyler	0	13	21	35	44	66	70	77
	Upshur	0	0	0	0	0	683	978	978
	Wayne	0	79	128	213	268	401	425	466
	Webster	0	1,045	1,381	1,381	1,381	1,381	1,381	1,381
	Wetzel	0	138	224	372	469	700	741	814
	Wyoming	0	962	1,162	1,641	1,686	1,748	1,748	1,748
Wyoming	Albany	0	0	0	0	0	81	81	81
	Big Horn	0	0	0	0	0	0	3	3
	Campbell	0	13,901	13,901	13,901	33,605	33,605	33,605	33,605
	Carbon	0	0	0	2,223	2,223	2,223	2,223	2,223
	Converse	0	0	0	1,636	1,636	1,636	1,636	1,636
	Crook	0	0	0	0	0	0	0	0
	Fremont	0	0	0	52	52	52	52	52
	Hot Springs	0	68	68	68	68	68	68	68
	Johnson	0	0	0	0	2,249	3,327	3,327	3,327
	Lincoln	0	1,556	1,556	1,556	1,556	1,556	1,556	1,556
	Natrona	0	0	0	35	35	35	35	35
	Park	0	0	0	29	29	29	29	29
	Sheridan	0	5,011	5,011	5,226	5,226	5,282	5,282	5,282
	Sweetwater	0	0	0	0	4,741	4,741	4,741	4,741
	Uinta	0	0	0	0	0	627	627	627
	Washakie	0	0	0	0	12	12	12	12
	Weston	0	0	0	0	0	0	0	0

[a] Entries indicate reserves with S/H ratio less than or equal to the indicated value and hence are cumulative in any row.

[b] Only those counties containing coal reserves are listed.

[c] Meets Federal New Source Performance Standards (NSPS) without flue gas desulfurization.

[d] Total reserves in Chatham and Lee counties less than 32 x 10^6 Tons. No analysis available.

Table 7. Counties with Coal Reserves that Failed to Pass Air Quality Screens

		Air Quality Screens			
				Measured Concentration[a,b]	
State	County[c]	UA[d]	AQMA[d]	TSP	SO_2
Alabama	Blount			A	-
	Cullman			S,A	-
	DeKalb			S	-
	Jackson			S,A	acc
	Jefferson			S,A	acc
	Shelby	X[e]		S,A	-
	St. Clair	X[e]		S,A	-
	Tuscaloosa	X		-	-
	Walker		X	S,A	-
Arkansas	Clark			S	-
	Ouachita			S	-
	Pope			S,A	-
	Pulaski	X	X	S,A	acc
	Saline		X	S,A	-
	Sebastian	X		S,A	-
Colorado	Adams	X	X	S,A	-
	Arapahoe	X	X	S,A	-
	Boulder	X	X	S,A	-
	Delta			S,A	-
	Douglas	X[e]	X	S,A	-
	El Paso	X	X[f]	S,A	-
	Fremont			S,A	-
	Garfield		X[f]	S,A	-
	Huerfano			S,A	-
	Jefferson	X	X	S,A	-
	Las Animas			S,A	-
	Mesa		X[f]	S,A	-
	Moffat		X[f]	S,A	-
	Montrose			S,A	-
	Pitkin			S,A	-
	Rio Blanco		X[f]	S,A	-
	Routt			S,A	-
	Weld		X[f]	S,A	-
Illinois	Bureau			S	-
	Jackson			S	-
	Kankakee			S	-
	Knox			S	-
	Lake	X	X	S	-
	Macon	X	X	-	-
	Madison		X	S,A	S
	Menard			S	-
	Monroe	X	X	S	-

Table 7. (Contd.)

		Air Quality Screens			
				Measured Concentration[a,b]	
State	County[c]	UA[d]	AQMA[d]	TSP	SO_2
Illinois (Contd.)	Peoria	X	X	S,A	acc
	Putnam			S	-
	Rock Island	X		S,A	-
	Sangamon	X		S	-
	St. Clair		X	S,A	-
	Tazewell	X	X	S	-
	Will	X	X	S,A	acc
	Woodford	X[e]	X	-	-
Indiana	Dubois			S,A	acc
	Knox			S,A	acc
	Parke			S	-
	Vanderburgh	X	X	S	acc
	Vigo	X		S,A	acc
Iowa	Hamilton			S	-
	Keokuk			S	-
	Lee			S,A	S
	Marshall			S,A	-
	Polk	X	X	S,A	acc
	Scott	X	X	S,A	acc
	Story			S	acc
	Webster			S	-
Kansas	Atchison			S,A	acc
	Cherokee			S,A	acc
	Cowley			S,A	acc
	Leavenworth			S,A	acc
	Linn			S,A	acc
Kentucky	Boyd	X		S,A	acc
	Christian			S	acc
	Daviess	X		S,A	acc
	Floyd			S	acc
	Greenup	X		S,A	acc
	Hancock			S,A	acc
	Henderson		X	S,A	S
	Hopkins			S	acc
	Knox			S,A	acc
	Laurel			S	acc
	Lawrence			S,A	acc
	Muhlenberg			S,A	acc
	Ohio			S	acc
	Pike			S,A	acc
	Pulaski			S	acc
	Warren			S,A	acc
	Whitley			S,A	acc

Table 7. (Contd.)

State	County[c]	Air Quality Screens: UA[d]	AQMA[d]	Measured Concentration[a,b]: TSP	SO_2
Maryland	Alleghany		X	S,A	S
	Garrett		X	S,A	S
Michigan	Bay	X		S,A	acc
	Genessee	X		S,A	acc
	Saginaw	X		acc	acc
Missouri	Adair			S,A	-
	Audrain			S,A	-
	Boone	X		S,A	-
	Callaway			S	-
	Cass	X	X	-	-
	Clay	X	X	S,A	acc
	Jasper			S	-
	Nodaway			S	-
	Ralls			S,A	-
	Ray			S,A	-
Montana	Cascade	X		S	-
	Custer		X[f]	S,A	-
	Richland			S	-
	Yellowstone	X		S,A	-
New Mexico	McKinley			S,A	-
	San Juan			S,A	acc
	Santa Fe		X	S,A	-
	Socorro			S	-
	Valencia			S,A	-
North Dakota	Burleigh			S,A	-
	Morton			S	-
	Stark			S	-
	Ward			S	-
	Williams			S	-
Ohio	Belmont	X	X	S,A	S,A
	Columbiana		X	S,A	S,A
	Jefferson	X	X	S,A	S
	Lorain	X	X	S,A	acc
	Mahoning	X	X	S,A	acc
	Monroe		X	S,A	S,A
	Scioto			S,A	S,A
	Stark	X	X	S,A	S
	Wayne	X		S	acc

Table 7. (Contd.)

State	County[c]	UA[d]	AQMA[d]	Air Quality Screens: Measured Concentration[a,b] TSP	SO_2
Oklahoma	LeFlore	X		-	-
	Mayes			S	-
	Muskogee			S	-
	Okmulgee			S	-
	Rogers		X	S,A	acc
	Seqoyah			S	-
	Tulsa	X	X	S,A	acc
	Wagoner	X[e]	X	-	-
Pennsylvania	Allegheny	X	X	S,A	S,A
	Beaver	X	X	S,A	-
	Blair	X		S,A	-
	Cambria	X	X	S,A	-
	Clarion			S	-
	Dauphin	X	X	S,A	-
	Fayette		X	-	-
	Indiana			S	acc
	Lancaster	X	X	S,A	acc
	Lawrence	X	X	S,A	-
	Luzerne	X	X	S,A	-
	Lycoming			S,A	-
	Somerset	X		-	-
	Washington	X[e]	X	S,A	-
	Westmoreland	X	X	S,A	-
Tennessee	Anderson			S	acc
	Hamilton			S,A	acc
	Roane			acc	acc
Texas	Bexar	X		S	acc
	Bowie	X		S,A	-
	Brazos	X		acc	-
Virginia	Pulaski			S,A	acc
	Russell			S	acc
	Tazewell			S	acc
	Wise			S,A	acc
Washington	King	X		S,A	acc
	Kittitas			S	-
	Pierce	X		S	acc
	Thurston			S	-
	Whatcom			S	-

Table 7. (Contd.)

		Air Quality Screens			
				Measured Concentration[a,b]	
State	County[c]	UA[d]	AQMA[d]	TSP	SO_2
West Virginia	Brooke	X		S,A	S,A
	Cabell	X		S	-
	Fayette			S,A	-
	Hancock	X		S,A	S,A
	Harrison			S	-
	Kanawha	X		S,A	S
	Marion			S,A	-
	Marshall	X		S,A	S,A
	Ohio	X		S,A	-
	Putnam	X[e]		S,A	acc
	Wayne	X		S	-
Wyoming	Albany			S,A	-
	Natrona			S,A	acc

[a]Based on highest reading for the county in EPA's Storage and Retrieval of Aerometric data (SAROAD) system for the most recent data year between 1972 and 1974. Short-term concentrations are estimated from annual summary statistics using Larsen's methods.

[b]A: annual violation
S: short-term violation
acc: No indications of violations in SAROAD.
-: No air quality data in SAROAD.

[c]Only those counties having coal reserves are listed here. The maps displayin the screens show additional areas which did not pass the screens, but which did not contain coal reserves.

[d]An "X" indicates that the county failed to pass the screen, that is, that the county was in an Urbanized Area or Air Quality Maintenance Area.

[e]County within 3-4 miles of major urban core of a defined Urbanized Area but not itself within the area.

[f]Special case AQMAs designated in expectation of large energy-related developments.

Table 8. Counties with Coal Reserves Passing Preliminary Screens

State	County
Alabama	Barbour
	Choctaw
	Coffee
	Crenshaw
	Dale
	Fayette
	Marion
	Marengo
	Pike
	Sumter
	Wilcox
Arizona	Apache
	Conconino
	Navajo
Arkansas	Bradley
	Calhoun
	Cleveland
	Crawford
	Dallas
	Franklin
	Grant
	Greene
	Hot Spring
	Johnson
	Logan
	Nevada
	Poinsett
Colorado	Elbert
	Montezuma
Illinois	Adams
	Bond
	Brown
	Calhoun
	Cass
	Christian
	Clark
	Clinton
	Coles
	Crawford
	Cumberland
	Douglas
	Edgar
	Edwards
	Fayette
	Fulton
Illinois (Contd.)	Franklin
	Gallatin
	Greene
	Grundy
	Hamilton
	Hancock
	Henry
	Jefferson
	Jersey
	Lawrence
	Livingston
	Logan
	McDonough
	McLean
	Macoupin
	Marion
	Mercer
	Montgomery
	Morgan
	Moultrie
	Perry
	Randolph
	Saline
	Schuyler
	Scott
	Shelby
	Stark
	Vermilion
	Wabash
	Warren
	Washington
	Wayne
	White
	Williamson
Indiana	Clay
	Daviess
	Fountain
	Gibson
	Greene
	Martin
	Owen
	Pike
	Posey
	Spencer
	Sullivan
	Vermillion
	Warrick

Table 8. (Contd.)

State	County	State	County
Iowa	Appanoose	Michigan	Huron
	Boone		Shiawassee
	Cass		Tuscola
	Dallas		
	Davis	Missouri	Barton
	Decatur		Bates
	Greene		Caldwell
	Guthrie		Carroll
	Hardin		Chariton
	Henry		Cedar
	Jasper		Dade
	Jefferson		Daviess
	Lucas		Grundy
	Mahaska		Harrison
	Marion		Henry
	Monroe		Howard
	Muscatine		Johnson
	Van Buren		Lafayette
	Wapello		Linn
	Warren		Livingston
Kansas	Bourbon		Macon
	Brown		Mercer
	Crawford		Monroe
	Franklin		Montgomery
	Nemaha		Pettis
	Osage		Putnam
			Randolph
Kentucky	Bell		Saline
	Breathitt		Scotland
	Butler		St. Clair
	Carter		Sullivan
	Clay		Vernon
	Clinton		Worth
	Crittenden		
	Edmonson	Montana	Big Horn
	Elliot		Blaine
	Grayson		Carbon
	Harlan		Chouteau
	Johnson		Dawson
	Knott		Fallon
	Leslie		Fergus
	Letcher		Garfield
	Magoffin		Glacier
	Martin		Judith Basin
	McLean		Meagher
	Morgan		McCone
	Owsley		Musselshell
	Perry		Powder River
	Union		Prairie
	Wayne		Roosevelt
	Webster		Rosebud
	Wolfe		

Table 8. (Contd.)

State	County	State	County
Montana	Sheridan	Oklahoma	Craig
(Contd.)	Stillwater	(Contd.)	Haskell
	Treasure		Latimer
	Wibaux		Nowata
			Okfuskee
New Mexico	Colfax		Pittsburg
	Lincoln		
	Rio Arriba	Pennsylvania	Armstrong
	Sandoval		Bedford
			Bradford
North Carolina	Chatham		Butler
	Lee		Cameron
			Carbon
North Dakota	Adams		Centre
	Billings		Clearfield
	Bowman		Clinton
	Burke		Columbia
	Divide		Elk
	Dunn		Fulton
	Golden Valley		Greene
	Grant		Huntingdon
	Hettinger		Jefferson
	McKenzie		Lebanon
	McLean		Mercer
	Mercer		McKean
	Mountrail		Northumberland
	Oliver		Schuylkill
	Renville		Sullivan
	Slope		Tioga
			Venango
Ohio	Athens		Wayne
	Carroll		
	Coshocton	South Dakota	Corson
	Gallia		Dewey
	Guernsey		Harding
	Harrison		Perkins
	Hocking		Zeibach
	Holmes		
	Jackson	Tennessee	Bledsoe
	Meigs		Clay
	Morgan		Chester
	Muskingum		Cumberland
	Noble		Fentress
	Perry		Grundy
	Tuscarawas		Marion
			Morgan
Oklahoma	Atoka		Overton
	Coal		Pickett

Table 8. (Contd.)

State	County	State	County
Tennessee (Contd.)	Putnam	Virginia	Buchanan
	Rhea		Dickenson
	Scott		Lee
	Sequatchie		Scott
	Van Buren		
	White	Washington	Lewis
Texas	Anderson	West Virginia	Barbour
	Baylor		Boone
	Burleson		Braxton
	Caldwell		Calhoun
	Camp		Clay
	Cass		Doddridge
	Cherokee		Gilmer
	Fayette		Grant
	Franklin		Greenbrier
	Freestone		Lewis
	Gregg		Lincoln
	Grimes		Logan
	Harrison		McDowell
	Henderson		Mason
	Houston		Mercer
	Lee		Mineral
	Leon		Mingo
	Madison		Monongalia
	Marion		Nicholas
	Milam		Preston
	Morris		Raleigh
	Nacogdoches		Randolph
	Panola		Roane
	Rains		Summers
	Robertson		Taylor
	Rusk		Tyler
	Titus		Upshur
	Trinity		Webster
	Van Zandt		Wetzel
	Walker		Wyoming
	Washington		
	Wood	Wyoming	Big Horn
			Campbell
Utah	Carbon		Carbon
	Emery		Converse
	Garfield		Crook
	Iron		Fremont
	Kane		Hot Springs
	Uintah		Johnson
	Wayne		Lincoln

Table 8. (Contd.)

State	County	State	County
Wyoming (Contd.)	Park		
	Sheridan		
	Sweetwater		
	Uinta		
	Washakie		
	Weston		

Table 9. Counties Most Likely to Provide Suitable FEC Sites

		SO_2 Removal Efficiency (%)															
		FEC Meeting EPA/Senate Class II Increment				FEC Meeting NAAQS (EPA Class III) and NSPS											
		5,000 MWe				5,000 MWe				10,000 MWe				20,000 MWe			
		Basic Center		Spread-out Center		Basic Center		Spread-out Center		Basic Center		Spread-out Center		Basic Center		Spread-out Center	
State	County[a]	0	80	0	80	0	80	0	80	0	80	0	80	0	80	0	80
Alabama	Choctaw		X		X		X		X								
	Fayette		X		X	X	X	X	X		X		X				
	Marengo		X		X		X		X								
	Marion		X		X		X		X		X		X				
	Wilcox		X		X		X		X								
Arkansas	Franklin				X		X		X								
	Logan		X		X		X		X								
Colorado	Elbert		X		X		X		X								
Illinois	Cass				X		X		X		X		X				
	Clark		X		X		X		X		X		X		X		X
	Coles		X		X		X		X				X				
	Crawford		X		X		X		X		X		X				X
	Douglas				X		X		X		X		X				
	Edgar		X		X		X		X		X		X				X
	Edwards				X		X		X								
	Fayette				X		X		X								
	Franklin		X		X		X		X		X		X		X		X
	Fulton						X		X				X				
	Gallatin				X		X		X				X				
	Grundy				X		X		X								
	Hamilton		X		X		X		X		X		X		X		X
	Jefferson		X		X		X		X		X		X		X		X
	Lawrence				X		X		X				X				
	Livingston				X		X		X				X				
	Marshall				X		X		X				X				
	McLean				X		X		X								
	Morgan				X		X		X		X		X				X
	Moultrie				X		X		X								
	Perry				X		X		X				X				
	Randolph						X		X				X				
	Shelby						X		X								
	Vermilion				X		X		X		X		X				
	Wabash				X		X		X				X				X
	Wayne		X		X		X		X		X		X				
	White		X		X		X		X				X				
	Williamson		X		X		X		X		X		X				X
Indiana	Clay		X		X		X		X		X		X		X		X
	Daviess				X		X		X				X				
	Gibson				X		X		X				X				X

Table 9. (Contd.)

State	County[a]	SO2 Removal Efficiency (%)															
		FEC Meeting EPA/Senate Class II Increment				FEC Meeting NAAQS (EPA Class III) and NSPS											
		[illegible] MWe				[illegible] MWe				[illegible] MWe				20,000 MWe			
		Basic Center		Spread-out Center		Basic Center		Spread-out Center		Basic Center		Spread-out Center		Basic Center		Spread-out Center	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Indiana (Contd.)	Greene				X		X		X		X		X				X
	Pike				X		X		X				X				X
	[illegible]		X		X	X	X	X	X		X		X				X
	Sullivan		X		X	X	X	X	X		X		X		X		X
	Vermillion		X		X		X		X		X		X				
	Warrick		X		X	X	X	X	X		X		X				X
Iowa	Monroe				X		X		X								
Kansas	Bourbon				X		X		X								
	Crawford				X		X		X								
Kentucky	Bell		X	X	X	X	X	X	X		X	X	X		X		X
	Breathitt		X	X	X	X	X	X	X		X	X	X		X		X
	Butler						X		X				X				
	Carter						X		X								
	Clay		X		X	X	X	X	X		X	X	X		X		X
	Harlan		X	X	X	X	X	X	X		X	X	X		X		X
	Johnson		X		X		X		X		X		X				X
	Knott		X	X	X	X	X	X	X		X	X	X		X		X
	Leslie		X	X	X	X	X	X	X		X	X	X		X		X
	Letcher		X	X	X	X	X	X	X		X	X	X		X	X	X
	Magoffin		X		X	X	X	X	X		X	X	X		X		X
	Martin		X		X	X	X	X	X		X	X	X		X		X
	McLean		X	X	X	X	X	X	X		X	X	X				X
	Morgan		X		X		X		X								
	Perry		X	X	X	X	X	X	X		X	X	X		X		X
	Union						X		X				X				
	Webster						X		X				X				
Missouri	Bates				X		X		X								
	Vernon						X		X								
Montana																	
	Big Horn		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Carbon		X		X		X		X								
	Dawson		X	X	X	X	X	X	X								
	Fallon		X	X	X	X	X	X	X		X		X				
	McCone		X	X	X	X	X	X	X								
	Musselshell		X	X	X	X	X	X	X		X	X	X		X	X	X
	Powder River		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Prairie		X		X	X	X	X	X		X	X	X		X		X
	Roosevelt		X		X	X	X	X	X		X		X				
	Rosebud		X		X		X		X		X		X		X		X
	Treasure		X	X	X	X	X	X	X	X	X	X	X		X		X
	[illegible]			X	X	X	X	X	X	X	X	X	X		X		X

Table 9. (Contd.)

		SO_2 Removal Efficiency (%)															
		FEC Meeting EPA/Senate Class II Increment				FEC Meeting NAAQS (EPA Class III) and NSPS											
		5,000 MWe				5,000 MWe				10,000 MWe				20,000 MWe			
		Basic Center		Spread-out Center		Basic Center		Spread-out Center		Basic Center		Spread-out Center		Basic Center		Spread-out Center	
State	County[a]	0	80	0	80	0	80	0	80	0	80	0	80	0	80	0	80
New Mexico	Colfax		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Sandoval				X		X		X								
North Dakota	Billings		X		X		X		X		X		X				
	Bowman				X		X		X								
	Divide		X		X		X		X								
	Dunn		X		X		X		X		X		X				
	Golden Valley		X		X		X		X		X		X				
	Hettinger				X		X		X		X		X				X
	McKenzie		X		X		X		X								
	McLean		X		X		X		X		X		X				X
	Mercer		X		X		X		X		X		X				
	Oliver				X		X		X		X		X				X
	Slope		X		X		X		X		X		X				X
Ohio	Athens				X		X		X		X		X				X
	Carroll				X		X		X		X		X				X
	Coshocton				X		X		X				X				
	Gallia				X		X		X				X				
	Guernsey				X		X		X		X		X				X
	Harrison				X		X		X		X		X				X
	Hocking				X		X		X		X		X				X
	Holmes				X		X		X								
	Jackson				X		X		X				X				
	Meigs				X		X		X				X				
	Morgan				X		X		X		X		X				X
	Noble				X		X		X		X		X				X
	Perry				X		X		X		X		X				X
Oklahoma	Haskell		X		X		X		X								
	Latimer		X		X		X		X								
Pennsylvania	Armstrong				X		X		X		X		X				X
	Bedford		X		X		X		X		X		X				
	Butler				X		X		X		X		X				X
	Carbon		X		X		X		X		X		X				
	Centre		X		X		X		X		X		X				
	Clearfield		X		X		X		X		X		X		X		X
	Clinton		X		X		X		X								
	Columbia		X		X		X		X		X		X				X
	Elk		X		X		X		X		X		X				
	Greene				X		X		X		X		X				X

Table 9. (Contd.)

		SO_2 Removal Efficiency (%)															
		FEC Meeting EPA/Senate Class II Increment				FEC Meeting NAAQS (EPA Class III) and NSPS											
		5,000 MWe				5,000 MWe				10,000 MWe				20,000 MWe			
		Basic	Center	Spread-out	Center	Basic	Center	Spread-out	Center	Basic	Center	Spread-out	Center	Basic	Center	Spread-out	Center
State	County[a]	0	80	0	80	0	80	0	80	0	80	0	80	0	80	0	80
Pennsylvania (Contd.)	Jefferson		X		X		X		X		X		X				X
	Lebanon		X		X		X		X		X		X				X
	Mercer						X		X				X				
	Northumberland		X		X		X		X		X		X				X
	Schuylkill		X		X		X		X		X		X				X
	Venango						X		X								
Tennessee	Morgan						X		X								
Texas	Robertson				X		X		X								
Utah	Carbon		X	X	X	X	X	X	X								
	Garfield		X		X		X		X		X		X				
	Kane				X		X		X		X		X				X
Virginia	Buchanan		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Dickenson		X	X	X	X	X	X	X		X	X	X		X	X	X
	Lee		X	X	X	X	X	X	X		X	X	X		X		X
	Scott		X	X	X	X	X	X	X								
Washington	Lewis		X		X		X		X		X		X				
West Virginia	Barbour				X		X		X		X		X				X
	Boone		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Braxton				X		X		X		X		X				X
	Clay		X	X	X	X	X	X	X		X	X	X		X		X
	Doddridge		X	X	X	X	X	X	X		X		X				X
	Gilmer				X		X		X		X		X				X
	Grant		X		X		X		X		X		X				
	Greenbrier		X	X	X	X	X	X	X		X	X	X		X		X
	Lewis				X		X		X		X		X				X
	Lincoln		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Logan		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	McDowell		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Mercer		X	X	X	X	X	X	X								
	Mineral		X		X		X		X		X		X				X
	Mingo		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Monongalia		X		X		X		X		X		X				X
	Nicholas		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Preston				X		X		X		X		X				X
	Raleigh		X	X	X	X	X	X	X		X	X	X		X	X	X

Table 9. (Contd.)

		FLC Meeting EPA/Senate Class II Increment				FLC Meeting NAAQS (EPA Class III) and NSPS											
		5,000 MWe				5,000 MWe				10,000 MWe				20,000 MWe			
		Basic	Center	Spread out	Center	Basic	Center	Spread out	Center	Basic	Center	Spread out	Center	Basic	Center	Spread out	Center
State	County[a]	0	80		80	0	80	0	80	0	80	0	80	0	80	0	80
West Virginia	Randolph		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Taylor				X		X		X		X		X				X
	Tyler		X	X	X	X	X	X	X		X		X				
	Upshur		X		X		X		X		X		X				X
	Webster		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Wetzel		X	X	X	X	X	X	X		X		X				X
	Wyoming		X	X	X	X	X	X	X	X	X	X	X		X	X	X
Wyoming	Campbell		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Carbon				X	X	X	X	X		X	X	X				
	Converse				X	X	X	X	X		X	X	X				
	Johnson		X		X		X		X		X		X		X		X
	Lincoln		X	X	X	X	X	X	X	X	X	X	X				
	Sheridan		X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Sweetwater		X		X		X		X		X		X		X		X
	Uinta		X		X		X		X								

Column heading above all groups: SO_2 Removal Efficiency (%)

[a] Only counties providing potential sites are listed.

Table 10. Number of Counties Passing Screens

State[a]	No. of Counties with Coal	Counties with Coal Passing Preliminary Screens	[illegible] Imposed on FEC Meeting NSPS, 5,000 MWe: 100 mi Buffer Zone 0	80	40 mi Buffer Zone 90	98	FEC Meeting EPA/Senate Class II Increment, 5,000 MWe: Basic Center 0	80	Spread-out Center 0	80	FEC Meeting NAAQS (EPA Class III) and NSPS, 5,000 MWe: Both Centers 0	80	10,000 MWe: Basic Center 0	80	Spread-out Center 0	80	20,000 MWe: Basic Center 0	80	Spread out [illegible] 0	80
Alabama	21	11			1	4	-	5	-	5	1	5		2		2				
Arizona	3	3				-	-	-	-	-		-		-		-				
Arkansas	20	13				2		1		2		2								
Colorado	26	2		1		1		1		1		1		-						
Georgia	2	-		-		-														
Illinois	68	50		6		19		10		25		26		12	-	22		4		9
Indiana	19	13		2		2		5		9	3	9		6	-	9		2		-
Iowa	28	20		1		1		-	-	1		1				-		-		
Kansas	11	6				2		-	-	2	-	2		-				-		-
Kentucky	48	25	7	10	11	16		13	8	13	11	17		12	11	15		10	1	12
[illegible]	2							-	-	-	-			-					-	
Michigan	6	3		-		-		-		-	-		-							
Missouri	39	29		-	-	2			-	1	-	2	-	-	-			-	-	
Montana	26	21	2	3	8	9	-	12	8	12	10	12	4	9	6	9		-	3	-
New Mexico	9	7						1	1	-	1	-	1	1	1	1		1	1	1
N. Carolina	2	2				-		-	-	-	-	-	-	-				-		
N. Dakota	22	16				6		8		11	-	11		8		8				5
Ohio	26	15		12		13		-	-	13	-	13		8		12	-			8
Oklahoma	16	8						2	-	2	-	2				-	-			
Oregon	1	-				-														
Pennsylvania	3[illegible]	24				14		11		14		16		13		14		1		9
S. Dakota	5	5				-				-		-				-				-
Tennessee	19	16		-		1						1						-		
Texas	37	32		1	-	1			-	1	-	1						-		
Utah	5				1	3		2	1	3	1	3		2		2	-	-	-	1
Virginia	9	4			4	4		4	1	1	1	1	1	3	3	3	-	3	2	3
Washington	6	1	-	-	-	-	-	1	-	1	-	1	-	1	-	1		-		-
W. Virginia	43	30	6	6	15	20		20	16	26	16	26	9	25	12	25		12	10	23
Wyoming	17	15	2	3	3	5	-	6	3	8	5	8	3	7	5	7	-	4	2	4
NATIONAL TOTAL	578	375	17	44	46	132	0	102	41	156	52	36	18	109	38	130	0	44	19	89

[a] Only states with coal reserves are listed.

Table 11. Allowable Air Quality Increments Under PSD Alternatives

Pollutant	Averaging Time	Allowable Air Quality Increment ($\mu g/m^3$)								
		Class I			Class II			Class III		
		EPA Regulation	Senate Proposal	House Proposal	EPA Regulation	Senate Proposal	House Proposal	EPA Regulation	Senate Proposal	House Proposal
SO_2	Annual	2	2	1.6	15	15	20	80	a	40
	24-hour	5	5	7.5	100	100	91	365	a	183
	3-hour	25	25	26.0	700	700	325	1300	a	650
TSP	Annual	5	5	7.5	10	10	19	75	a	38
	24-hour	10	10	15.0	30	30	38	150	a	75

[a] No Class III in Senate proposal.

Note: Based on September 1975, congressional discussion drafts as shown in Ref. 17, p. 5.

Table 12. Coal Quality Requirements for Plants Meeting EPA/Senate Class II Increment[a]

	S/H (% S/10³ BTU/lb)			
	Flue Gas Desulfurization Efficiency			
	Basic Center		Spread-out Center	
Capacity (Mwe)	0%	80%	0%	80%
5,000	.023	.115	.054	.270
10,000	.012	.058	.027	.135
20,000	.006	.029	.014	.068

[a]Coal quantity requirements are the same as given on Table 3.

REFERENCES AND NOTES

1. *Assessment of Energy Parks vs. Dispersed Electric Power Generating Facilities*, National Science Foundation Report, NSF 75 500, 2 Vols., pp. ES-1 to ES-29, 1/2-5 to 1/2-226, and 7-1 to 7-21 (1975). (Referred to as *NSF Report*.)

2. *IBID.*, pp. 1/2-96 to 1/2-100.

3. Albert E. Smith, Thomas D. Wolsko, and Richard R. Cirillo, *[illegible] and Air Quality Limitations on Fossil-Fueled Energy Centers: Interim Report*, unpublished information (1975).

4. *NSF Report*, *op. cit.*, pp. 1/2-10[illegible], 1/2-169, 1/2-170, and 1/2-187.

5. *Compilation of Air Pollutant Emission Factors*, 2d ed., U.S. EPA Publication No. AP-42. Air Pollution Technical Information Center, Research Triangle Park, N.C. (1975).

6. *NSF Report*, *op. cit.*

7. The boundaries of these national public lands were taken from maps provided by the Nuclear Regulatory Commission, Office of Special Studies, 7735 Old Georgetown Road, Bethesda, MD 20014.

8. *U.S. Census of Population: 1970, Number of Inhabitants*, U.S. Department of Commerce, Bureau of the Census, U.S. GPO, Washington, D.C. 20402, Final Reports, PC(1)-A-4 Ala. to PC(1)-A52 Wyo.

9. *County and City Data Book 1972*, U.S. Department of Commerce, Bureau of the Census, U.S. GPO, Washington, D.C. 20402

10. *Maintenance of National Ambient Air Quality Standards* (40 CFR 52), 40 FR 18726, April [illegible], 1975 et seq. Corrections to the Federal Register listings of AQMAs have recently been published. We used a list of geographic locations obtained in a private communication from Dave Sanchez, Standards Implementation Branch, U.S. Environmental Protection Agency, Research Triangle Park, N.C. 27711.

11. *National Survey of State Implementation Plan Review*[illegible], *Volume II - Technical Support Document*, Energy and Environmental Systems Division, Argonne National Laboratory and U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA publication no. EPA-450/3-75-053-b. (The comparisons in Table 4 of this report differ from those in the *National Survey* for some states due to the redesignation of the old federal annual secondary TSP standard as a guide only.)

12. The various state standards were obtained from a series of 55 reports, *Implementation Plan Review for (State) as Required by the Energy Supply and Environmental Coordination Act*, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards (1975).

13. Ralph I. Larsen, *A Mathematical Model for Relating Air Quality Measurements to Air Quality Standards*, U. S. Environmental Protection Agency, Research Triangle Park, N.C. 27711, 1971, EPA Publication no. AP-89 (Nov 1971).

14. This information came from a tape prepared by Bechtel from Bureau of Mines data. The tape was prepared under Contract No. 14-32-0001-1552 of the U.S. Department of the Interior, Office of Coal Research in conjunction with the report, *Clean-Coal Energy: Source-to-Use Economics*, (Dec 1974).

15. James Trumball, "Coal Fields of the United States. Sheet 1," U.S. Geological Survey, Reston, Va. 22092 (1960).

16. R. R. Cirillo, T. D. Wolsko, R. Mueller, M. Senew, P. Mausvardis, K. Gamauf, D. Seymour, *An Evaluation of Regional Trends in Power Plant Siting and Energy Transport*, unpublished information (1976).

17. A more complete discussion of the various proposals is contained in *An Analysis of the Impact on the Electric Utility Industry of Alternative Approaches to Significant Deterioration*. Environmental Protection Agency and Federal Energy Administration Report No. EPA/D-75-085, 2 Vols (Oct 1975). (Referred to as *EPA/FEA Report*.)

18. *Prevention of Significant Air Quality Deterioration* (40 CFR 52), 39 FR 42510 (Dec 5, 1974).

19. *EPA/FEA Report*, *op. cit.*, p. 1.

20. *EPA/FEA Report*, *op. cit.*, p. 8.

21. *EPA/FEA Report*, *op. cit.*, p. 28.

22. *EPA/FEA Report*, *op. cit.*, p. B-5.